THREE ESSAYS IN CORPORATE FINANCE

by

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ABSTRACT

JUN CHEN Three essays in corporate finance.
(Under the direction of DR. TAO-HSIEN DOLLY KING)

The economy and market have dramatically developed over the past decades. The corporations try to survive and urge to grow in such erratic circumstance. Two key dimensions are involved in winning a game of *the law of the jungle*: the management of minimum risk and the acquisition of maximum resource. This research studies risk management by investigating the usage of derivatives for hedging, and studies the acquisition of resource by examining corporate alliance activities. In the following each chapter we tend to answer whether and how corporate hedging and corporate alliance create value for firms, particularly for bondholders and shareholders.

Chapter I we empirically examine the relation between corporate hedging and the cost of debt. Corporate finance theories suggest that firms benefit from hedging due to the reduction of bankruptcy risk, the mitigation of agency problems, and the alleviation of information asymmetry (Smith and Stulz (1985), Froot, Scharfstein, and Stein (1993), Campbell and Kracaw (1990), Bessembinder (1991), and DeMarzo and Duffie (1991)). In this paper, we empirically examine the relation between corporate hedging and the cost of public debt. Using a large sample of 1,832 U.S. firms from 1994 to 2009, we find strong evidence that hedging is associated with a lower cost of debt. On average, the cost of debt for hedgers with an investment grade rating is 19.2 basis points lower than that for non-hedgers. For speculative grade issuers, hedging firms pay a cost of debt that is 45.2 basis points lower than that of the non-hedgers. The negative effect of hedging on the cost of debt is similar across industry groups, and remains robust under a comprehensive set of controls and econometric specifications. Hedging initiation firms experience a drop in the cost of debt, while suspension firms bear a jump. We perform an

extensive set of robustness tests to address the possible issue of endogeneity and the results remain strong in all tests. We further show that hedging leads to a drop in the cost of debt by reducing bankruptcy risk and the level of information asymmetry. However, we do not find evidence to support that hedging reduces the cost of debt by mitigating agency conflicts. Finally, hedging mitigates the negative effect of an increase in the cost of debt on capital expenditure and firm value, therefore suggesting that hedging promotes firm investment and creates value

As an extension, in Chapter II we explore the influence of governance structure on managerial risk attitude, in particular, hedging decision. Corporate governance refers to the set of mechanisms that control firm decisions affecting the interest of firm shareholders, bondholders and managers. But the attitudes of stakeholders may diverge on risk preference due to their own interest. In this research we propose three hypotheses: (1) Hedging overcomes the inefficient market and maximizes firm value, so strong shareholder (bondholder) rights are positively related to the hedging strategy. (2) Hedging mitigates the risk-shifting problem and facilitates conservative firm investments, so strong shareholder rights are negatively related to the hedging strategy, whereas strong bondholder rights are positively related to the hedging strategy. (3) Hedging is used by managers for private benefits or earnings management purpose, so strong shareholder(bondholder) rights should be negatively related to the hedging strategy. By performing a comprehensive set of controls and robustness tests, we find strong evidence that both shareholder rights and bondholder rights are significantly and positively associated with corporate hedging decision. Our empirical research suggests that hedging is primarily used as a value-maximization device to both shareholders and bondholders.

In Chapter III, we investigate whether joint ventures and strategy alliances create value for bondholders and stockholders by examining the wealth effects around the announcements of alliance events. Based on 3,243 alliance announcements from 1984 to

2011, we find that alliances create value for bondholders and stockholders. In a 2-month window, the mean abnormal return is 0.67% for bondholders and 1.06% for stockholders. We explore various explanations for the wealth effects. Joint ventures create value to bondholders through financial synergy and to shareholders through operating synergy. In addition, alleviation of financial constraints hypothesis holds for shareholder reaction, but does not help explain bondholder wealth effect. Moreover, uncertainty about profitability in the alliance industry has a positive and significant effect on bondholder and stockholder value. For strategic alliances, both financial and operating synergy effects contribute to bondholder wealth. Uncertainty about product market is significant for shareholder wealth. Finally, a bond-level analysis reveals that the impact of synergy effect on bondholder wealth varies significantly by convertibility, credit rating and the priority structure of bond contracts.

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CHAPTER 1: CORPORATE HEDGING AND THE COST OF DEBT

1.1 Introduction

Hedging is a widely used corporate policy around the world. The survey by Rawls and Smithson (1990) shows that financial executives rank risk management as one of their most important duties. Howton and Perfect (1998) document that 61% of the Fortune 500/S&P 500 firms, and 36% of a randomly selected sample use currency and interest rate derivatives. Based on a sample of 7,319 firms from 50 countries, Bartram, Brown and Fehle (2009) find that more than 60% of the firms use currency, interest rates, or commodity derivatives.

A well-known benefit of hedging is that hedging helps smooth firm performance, resulting in lower volatility of net income and cash flows. In the seminal paper, Stulz (1984) presents the optimal hedging policies for risk-averse managers and value-maximizing shareholders. Subsequently, several motivations for hedging are developed in the literature: reduction in bankruptcy costs (Smith and Stulz (1985)), lower likelihood of financial distress (Smith and Stulz (1985)), lower taxes (Smith and Stulz (1985)), mitigation of agency costs associated with underinvestment and risk-shifting problems (Froot, Scharfstein, and Stein (1993), Bessembinder (1991), and Campbell and Kracaw (1990)), and less information asymmetry (DeMarzo and Duffie (1991)). Empirical studies suggest a positive relation between hedging and firm value (Carter, Rogers, and Simkins (2006), and Allayannis and Weston (2001)). Recent studies provide further evidence thathedging affects the level and volatility of shareholder returns (Bartram, Brown, and Conrad (2011), Gay, Lin, and Smith (2010), Nelson, Moffitt, and Affleck-Graves (2005),

and Guay (1999)). For example, Guay (1999) finds that firms using derivatives hedging experience a significant reduction in interest rate exposure, exchange rate exposure, and stock return volatility. Nelson, Moffitt, and Affleck-Graves (2005) report significant abnormal stock returns for currency hedgers, outperforming their peers by 4.3% per year. Gay, Lin and Smith (2010) show that the cost of equity for derivatives users is lower than that of the non-users by 24 to 78 basis points (bps). Bartram, Brown, and Conrad (2011) document lower idiosyncratic volatility and systematic risk for hedging firms based on an international sample.

Although the literature provides support for the positive effects of hedging policy on overall firm and shareholder values, research examining the effects of hedging on bondholder value and the cost of debt is surprisingly lacking. Our paper fills this gap in hedging literature by answering three important questions: (a) Is the cost of debt lower due to hedging strategy? (b) If so, how does hedging reduce the cost of debt? (c) How are firm investment and value impacted by the negative influence of hedging on the cost of debt? Such research is important because debt financing is a major capital source for firm operations. More specifically, we focus on the public bonds when measuring a firm's overall cost of debt based on the following two reasons. First, while we recognize that firms use a variety of debt sources, capital from public bonds is worthy of keen attention because of its strong representation in the structure of long-term capital. In a recent study, Colla, Ippolito, and Li (2013) report the dominance role played by bond capital in a firm's debt structure based on a large sample of U.S. firms from 2002 to 2009. More than 64% of the firms rely on senior bonds and notes for financing. More importantly, the median (mean) ratio of senior bonds and notes to total debt is 0.208 (0.382), which is larger than any of the alternatives, such as drawn credit lines, term loans or capital leases. In addition, Rauh and Sufi (2010) find that bonds make up about 19% of capital structure, while bank loans make up around 13% of capital structure. Second, the

cost of public bonds represents the long-term capital cost that is used, along with the cost of equity, to estimate firm value on an on-going basis. Public bonds are generally of long-term maturity with an average of 10 to 13 years. On the other hand, private debt such as 364-day facility, revolver (or multi-year revolver), and term loans is mainly for the purposes of short-term financing, funding for unexpected events (takeovers), and debt repayment. Long-term capital sources including equity and bonds tend to be the main funding support for corporate investments in capital expenditure and R&D. In recent literature, several papers use the cost of public bonds as the measure of cost of debt (e.g., Kisgen and Strahan (2010), Cremers, Nair, and Wei (2007), Klock, Mansi, and Maxwell (2005), and Reeb, Mansi and Allee (2001)).

Our second question focuses on the explanations for the relation between hedging and the cost of debt. Given the literature on hedging premium, an extensive investigation of the mechanisms through which hedging exerts a negative influence on cost of debt is very important from both theoretical and managerial perspectives. Reduction in bankruptcy risk and earnings volatility should result in a significantly lower cost of debt. Minton and Schrand (1999) suggest that lower earnings variability is associated with a lower weighted average cost of capital. In addition, the lessening of underinvestment problem, risk-shifting hazard, and/or information asymmetry should lead to a lower cost of debt. Finally, in the third question we examine an issue *not yet* explored in the literature, namely, how the reduction in cost of debt from hedging results in an economic impact on firm investments and value.

Based on sample data from Mergent's Fixed Income Securities Database (FISD), TRACE, and EDGAR, we examine the use of Foreign Currency Derivatives (FCDs), Interest Rate Derivatives (IRDs) and Commodity Derivatives (CDs) in 2,612 U.S. companies that have valid bond transaction data from 1994 through 2009. Our findings indicate a negative association between hedging and the cost of debt. We find that on

average, bond yield spreads for hedging firms are 49.1 bps lower than those for non-hedging firms. Using multivariate regressions, we confirm a negative and significant relationship between hedging and the cost of debt. Hedging results in a significant drop of 40.8 bps in the cost of debt after controlling for firm-level and bond-level variables, and a drop of 24.1 bps (or $2.23 million saving in the cost of debt) after incorporating additional controls for market factors. By dividing the sample into investment- and speculative-grade subsamples, we find that hedging leads to more than double the reduction in the cost of debt for speculative-grade issuers (45.2 bps) compared with that for investment-grade ones (19.2 bps). Regression results confirm that speculative-grade firms enjoy a larger drop in the cost of debt from hedging strategy than investment-grade firms. Such results suggest that hedging is more valuable for the firms with greater credit risk. We also categorize the sample into industry groups and find that the impact of hedging remains robust across industries.

In a novel experiment, we examine the cross-sectional difference of hedging behavior on the cost of debt using firms that initiate hedging and those that suspend hedging during the sample period. After matching each hedging initiation or suspension firm with a control firm based on the methodology of propensity score matching (PSM), we observe that initiating firms have a significantly larger drop in yield spread after they start hedging. On the other hand, hedging suspension firms experience a significantly larger jump in yield spread after suspension. These findings provide strong support for the hedging effect on the cost of debt.

To address the potential issue of model misspecifications and to capture the effect of time-varying firm characteristics, we employ the firm fixed effect model, and find that the impact of hedging on the cost of debt remains negative and significant. Moreover, we acknowledge it is possible that the observed relation is subject to endogeneity, that is, hedging strategy can be self-selected, or that firms with a high cost of debt are more

likely to hedge. To address these concerns, we perform an extensive set of robustness tests including the lagged variables regression, Heckman's treatment effect model, propensity score matching, instrumental variables (IV) estimation, simultaneous equations model (SEM), and dynamic panel GMM model. After addressing the possible issues of unobservable factors, self-selection bias, reverse causality, and dynamic endogeneity, the negative and significant association between hedging and cost of debt remains strong. This suggests that the impact of hedging on cost of debt is substantial and cannot be attributed to endogeneity.

We further explore the sources of hedging benefits in reducing the cost of debt. Using multivariate analyses, we find that the interaction term of hedging and the proxy of financial risk have a significant and negative effect on the cost of debt. In other words, hedging benefit is stronger for firms with higher financial risk than those with lower financial risk. The result suggests that hedging reduces the probability of financial distress, resulting in a lower cost of debt. This finding provides evidence for the financial risk hypothesis. Additionally, we show that the interaction term of hedging and the information asymmetry proxy has a significantly negative impact on the yield spread. The result suggests that opaque firms enjoy a larger drop in the cost of debt by hedging than transparent firms. This finding supports the information asymmetry hypothesis by implying that hedging helps bondholders attain more precise assessment of firm value and operational performance, and hence shrinks the "transparency spread". On the other hand, we find little support for the agency cost hypothesis. The interaction term of hedging and the agency cost proxy is not significant in all regressions. Due to the lack of support, we speculate that the impact of hedging on the cost of debt through mitigating agency problems is minimal.

Given the strong effect of hedging on the cost of debt, another important and interesting issue is the economic value of hedging policy. To gain insight on this issue,

we examine whether hedging helps reduce the unfavorable effect of high borrowing cost on firm's investment policy and value. This investigation of the conditional impact of hedging is different from the existing research, and generates meaningful implications that are germane to our analysis of cost of debt. Our results indicate that hedging alleviates the negative impact of an increase in the cost of debt on firm investment. Furthermore, along the same line of reasoning, hedging is documented to mitigate the negative effect of a high cost of debt on firm value. Based on the methodology of Faulkender and Wang (2006), we discover that for a one percent increase in the cost of debt, non-hedger loses 1.26 percent in excess stock return, while hedger loses 0.68 percent.

This study makes the following major contributions to the literature. First, we add to the limited research on how hedging affects the cost of debt. We empirically examine the relation between corporate hedging and the cost of public bonds and present a strong link between these two. Deng, Elyasiani, and Mao (2010) investigate the effect of hedging on the cost of debt for bank holding companies. However, they do not find a significant reduction in the cost of debt for hedging banks, and suggest that hedging motivates banks to involve in riskier loan contracts. On the other hand, Campello et al. (2011) show that hedging has a first-order effect on firms' bank loan financing. Different from them, we focus on public bonds which constitute a prominent part of a firm's debt financing and are regarded as a main source for long-term capital. Public bonds also provide a unique laboratory to examine in depths of the hedging benefits in reducing the borrowing cost. Compared to banks, public bondholders are more vulnerable to bankruptcy risk, information asymmetry and risk-shifting hazard due to limited access to firm's inside information, less power in renegotiations and longer term in maturity (Denis and Mihov, 2003) and therefore are more sensitive to the benefits of hedging. In the hedging literature, using publicly traded bonds enables us to be less immune to the

problem of reverse causality since the majority of public bondholders, such as mutual funds, pension funds, insurance companies, government agencies, and foreign institutions, are generally not the sellers of derivatives. Additionally, our cost of debt measure based on market transactions can avoid the potential underestimation problem in private loans data uncovered by Berg, Saunders, and Steffen (2013). Second, most of the existing research on hedging focuses on specific industries (e.g., the oil and airline industries) using a limited sample period. We recognize the advantage of using the single-industry analysis: this method can avoid the heterogeneity in hedging behavior among different industries. For example, the motivation and types of hedging instruments are likely to vary across industries. By employing a large sample consisting of companies across a wide array of industries and over an extended period, we are able to investigate corporate hedging policy and its relation with the cost of debt across industries with distinct characteristics and across economic cycles. To address the issue of heterogeneity in hedging across industries, we perform analyses based on the full sample and at the industry level. We provide general implications for the impact of hedging using the full sample results and highlight interesting differences using the industry-level results. Our findings, which are based on a long horizon, help resolve some of the inconsistencies in existing studies. If firms use derivatives mainly for short-term contracts or transactions, hedging should not lead to persistent and significant effects on the cost of capital and firm value. By presenting strong evidence that hedging reduces the cost of public debt, we provide confirmation on the long-term benefit of hedging. Third, we perform a wide range of robustness tests to address the potential issues of model misspecification, time-varying firm characteristics, and endogeneity due to self-selection, reversal causality, and dynamic endogeneity. Forth, this research sheds light on the sources of hedging benefits that the firms enjoy in terms of a drop in the cost of debt. Finally, we show that hedging

attenuates the negative impact of an increase in cost of debt on firm investment and value, and therefore leads to more investments and creates value for the firm and shareholders.

The paper is structured as follows. Section 2 reviews the extant literature on the motivation for hedging and the link between hedging and the cost of debt. Section 3 describes our sample and data sources, and identifies the firm-level, bond-level, and market risk factors of the cost of debt. Section 4 reports the empirical results of the hedging impacts on the cost of debt. Section 5 explores the financial risk, agency cost, and information asymmetry hypotheses regarding hedging benefits. Section 6 presents an analysis of economic value of hedging. Section 7 concludes.

1.2 Literature Review

1.2.1 Hedging and Firm Value

Classic capital structure theory suggests that financial policy has no impact on firm value and hedging should be irrelevant if investors (shareholders) can adopt "home-made hedging." Mayers and Smith (1982) propose several motivations as to why firms with well-diversified shareholders choose to insure their assets.[1] Subsequent literature extends these rationales to hedging. In practice, hedging can be traced back to Japanese farming in the 17th century.[2] However, there was very little research on the topic prior to the 1980s due to limitations on data. In earlier research, the results based on survey data suggest that executives view hedging as an important corporate policy to help reduce the firm's exposure to risk.[3] During the 1990s, more data on hedging became available as a result of the regulatory requirements on the disclosure of derivatives usage.[4] Consequently, most studies emerge and document that hedging strategy provides

[1] Mayers and Smith (1982) discuss seven benefits: "1) Allocate risk to those stakeholders who have comparative advantage to take risk; 2) lower expected transaction costs of bankruptcy; 3) provide real service efficiencies in claims administration; 4) monitor the compliance of contractual provisions; 5) bond the firm's real investment decisions; 6) lower the corporation's expected tax liability; and 7) reduce regulatory costs."

[2] Souza, C. D., Hedging history: rice to swaps, Professional Wealth Management, August 2003.

[3] For example, see Nance, Smith, and Smithson (1993).

[4] See SFAS 105, SFAS 107, SFAS 119 and SFAS 133 from *www.fasb.org*.

substantial benefits. Géczy, Minton, and Schrand (1997) examine a sample of 372 *Fortune 500* non-financial firms and suggest that hedging is used to reduce cash flow fluctuations. Haushalter (2000) investigates hedging behavior in oil and gas companies and finds that the extent of hedging is related to the factors associated with external financing. Allayannis and Weston (2001) document a significant hedging premium as large as 4.87% of firm value for large non-financial firms. A higher hedging premium of 10% is reported by Carter, Rogers, and Simkins (2006) when they examine the U.S. airline industry. Similarly, Kim, Mathur, and Nam (2006) show that hedging increases firm value by 5.4% based on a sample of U.S. firms that hedge with currency derivatives. Mackay and Moeller (2007) also find an increase of 2 to 3% in Tobin's Q resulting from hedging for 34 oil refineries. Bartram, Brown, and Conrad (2011) point out hedging firms have significantly lower cash flow volatility, idiosyncratic volatility and systematic risk. Allayannis, Lel, and Miller (2012) find that hedging through the use of currency derivatives increases firm value when it is combined with a strong governance structure. Conversely, Tufano (1996) examines the hedging policy of gold mining companies and finds no significant relation between hedging and motivations proposed in the literature. Jin and Jorion (2006) also find no relationship between hedging and firm value based on a sample of 119 oil and gas firms from 1998 to 2001.

1.2.2 Hedging and the Cost of Capital

Corporate finance theory formulates that firm value is the present value of future cash flows. Therefore, the impacts of hedging on firm value can be from: the effect on the cash flow stream and/or the impact on the cost of capital by which future cash flows are discounted. Easley and O'Hara (2004) highlight that the cost of capital is fundamental in corporate policies because of its impact on profitability, and hence investment decisions. Recent studies suggest that hedging has notable influences on the cost of equity (e.g., Gay, Lin and Smith, 2010). As to the cost of debt, theories suggest a close link between

hedging and a firm's borrowing cost. Below we summarize three major theories on hedging benefits and discuss how each supports the relation between hedging and the cost of debt. Note that several of the theories below apply more closely to the cost of public (instead of private) debt.

Reduced Bankruptcy Cost: The probability of bankruptcy or financial distress is considerably higher when a firm's earnings or cash flows are more volatile. Because hedging helps smooth corporate income or cash flows, bankruptcy risk is reduced. In particular, Smith and Stulz (1985) suggest that hedging reduces a firm's cash flow volatility and consequently lowers the expected cost of financial distress. As a result, we conjecture that hedging should lead to a lower cost of debt. In addition, highly leveraged firms often cannot afford a large debt capacity since the cost of debt is high. Graham and Rogers (2002) find that hedging helps increase debt capacity, leading to an average increase of 1.1% in firm value.

Lower Agency Cost of Debt: Myers (1977) suggests that firms with risky debt may forgo positive NPV projects if some or all of the value of the project goes toward the bondholders when poor states occur. Hedging alleviates the underinvestment problem by reducing the probability of the poor states occurring. Therefore, shareholders have greater incentives to invest in value-enhancing projects (Bessembinder (1991)). Froot, Scharfstein, and Stein (1993) theorize that hedging curtails the underinvestment problem when a firm faces growth opportunities and a high cost of external financing. In this case, hedging leads to managers following the optimal investment policy by generating sufficient internal funds and having a low cost of capital. Second, hedging mitigates the risk-shifting problem (Campbell and Kracaw (1990)). The theory of risk-shifting (or asset substitution) suggests that managers have incentives to increase equity value by investing in high-risk, but negative NPV, projects when there is a significant probability of default. By the same token, shareholders harvest the benefits if projects perform well, but

bondholders bear the costs if the opposite occurs. The risk-shifting problem becomes more severe as the risk of financial distress increases. Furthermore, literature suggests that high-growth firms suffer more risk-shifting problems. Hedging reduces the risk of financial distress and volatility of asset returns, resulting in less severe risk-shifting problems. Therefore, by mitigating underinvestment and risk-shifting problems, hedging should lead to a lower agency cost of debt.

Lower Level of Information Asymmetry: Literature indicates that managers have better information about firm performance than outsiders. As the release of information is costly and managers may have incentives to distort or not fully disclose information for private benefits, investors do not have full information on asset values or their information set is noisy. As a result, information asymmetry affects equilibrium asset prices and expected rates of return by influencing the investors' assessments regarding the distribution of future cash flows. Easley and O'Hara (2004) demonstrate that investors demand a higher return on stocks with more private information. Duffie and Lando (2001) argue that information content and quality based on accounting disclosure are critical for bondholders to retrieve a conditional distribution of an issuer's asset value. Yu (2005) empirically supports this "transparency spread" by documenting that a reduction in the precision of accounting information is associated with a widening of credit spreads. Since hedging reduces the volatility of a firm's cash flow stream, and consequently making cash flows more predictable, we speculate that bondholders demand a lower rate of return for hedging firms.

In addition to the literature linking hedging to the cost of debt, our study is also related to the research on the determinants of cost of debt. Merton (1974) argues that the value of corporate debt is determined by the risk-free rate, bond provisions and covenants, and the probability of default. Recent studies investigate how the cost of debt relates to the optimal financing decisions (Binsbergen, Graham, and Yang (2010)), market for

corporate control (Qiu and Yu (2009)), and corporate governance (Cremers, Nair, and Wei (2007) and Klock, Mansi, and Maxwell (2005)).

1.2.3 Sources of Hedging Benefit: Reduction in the Cost of Debt

Based on the above theoretical support for how hedging reduces the cost of debt, we develop the following hypotheses about the sources of hedging benefits.

Hypothesis 1: Hedging leads to a greater reduction in the cost of debt for firms with a higher bankruptcy or financial distress risk. When financial distress is costly, firms benefit from hedging because it reduces the likelihood of bankruptcy or financial distress. Firms with a higher default risk benefit more as they have a greater probability of financial distress. Firms with a small probability of default are not in great need for hedging (ceteris paribus) because default is unlikely. Using credit rating and financial leverage as proxies for default risk, we expect a significantly larger reduction in the cost of debt for lower-rated (higher-leveraged) issuers than for higher-rated (lower-leveraged) ones. We also use interest coverage ratio and Altman's Z score as alternative measures of default risk.

Hypothesis 2: The impact of hedging on lowering the cost of debt is greater for firms with more severe agency problems than those with less. Jensen and Meckling (1976) suggest that firms with significant financial risk may overinvest in high-risk projects, as shareholders benefit most in favorable states and bondholders bear the losses in poor states. Hedging helps smooth out the peaks and troughs of firm performance, reducing the volatility of earnings and cash flows. Thus, hedging alleviates the risk-shifting problem by reducing the probability of default and earnings volatility. Similarly, hedging helps mitigate the underinvestment problem by reducing the probability of poor states occurring. Firms with a severe risk-shifting and/or underinvestment problem carry a high agency cost of debt, and are more likely to benefit from hedging. Beatty, Petacchi, and Zhang (2012) show that interest rate protection covenants mandated by bank creditors

help mitigate agency conflicts between creditors and shareholders. To measure the severity of agency problems, we look to the literature for appropriate proxies. Studies suggest that high-growth firms suffer more underinvestment and risk-shifting problems (e.g., Froot, Scharfstein, and Stein (1993)). In addition, convertible bond issuers (Green (1984)) and firms with bonds containing the investment covenants or collateral (Smith and Warner (1979)) are less vulnerable to the risk-shifting hazard. We predict a greater impact of hedging on the cost of debt for high-growth firms, and a smaller effect for convertible bond issuers or firms with bonds containing investment or security covenants.

Hypothesis 3: As hedging reduces the "transparency spread" in the cost of debt, we propose that hedging leads to a larger drop in the cost of debt for firms with a greater level of information asymmetry. This conjecture is consistent with the model of DeMarzo and Duffie (1991), which suggests that opaque firms enjoy greater hedging benefits. Provided that hedging can smooth the firm's cash flows and reduces the volatility of asset returns, investors are able to arrive at a better estimation of firm value. DaDalt, Gay, and Nam (2002) find that the use of derivatives is associated with a lower level of information asymmetry. To measure the extent of information asymmetry, we first employ two commonly used proxies based on analyst forecasts: earnings forecast error and dispersion. We also use accruals to proxy for accounting transparency. Duffie and Lando (2001) argue that incomplete accounting information and discretionary disclosure are important factors of information asymmetry. Sufi (2007) points out that firms with positive accounting accruals have a lower degree of accounting transparency. Overall, our hypothesis suggests that hedging has more pronounced effects on the cost of debt for firms with a larger earnings forecast error, a greater earnings forecast dispersion, or positive accounting accruals.

1. 3 Sample and Summary Statistics

1. 3.1 Sample Selection

From the Mergent's Fixed Investment Securities Database (FISD), we use all transactions of public bonds from the National Association of Insurance Commissioners (NAIC) during the period from 1994 through 2009 and FINRA's Trade Reporting and Compliance Engine (TRACE) from 2002 through 2009. We collect issuer and issue characteristics including SIC code, coupon rate, issue and maturity dates, bond size, Moody's ratings, duration, convexity, callability, putability, and convertibility. We exclude government, agency, and financial bonds. We next require that the issuers have valid CIK codes in COMPUSTAT. The merge yields a sample of 2,797 firms and 13,970 bond issues, which constitutes our initial sample.

Using the sample of 2,797 firms, we identify whether a firm is involved in hedging activities by examining the 10-K filings from 1993 to 2008 in the EDGAR database. In particular, we perform a keyword search for derivatives uses in the 10-K reports. For example, to identify the use of Foreign Currency Derivatives (FCDs), we use the following set of keywords: *currency derivative, currency swaps, currency forwards, currency futures, currency options, currency contract, currency forward contract, exchange forward, exchange futures, exchange swap, exchange option, exchange contract,* and *forward exchange contract*.[5] When a keyword is found, we review the context in which the keyword appears in the report to confirm the use of derivatives for hedging.[6] Following Nance, Smith, and Smithson (1993) and Géczy, Minton, and Schrand (1997), we use a dummy variable to represent if a firm hedges in a given year. In particular, the dummy variable for hedging equals one in a given year if a firm holds a hedging position at the end of the fiscal year or has derivatives transactions for the

[5] We also use other curtailed keywords, but find no significant differences in the results.

[6] Accounting rules require firms to disclose the purpose of holding or using derivatives to be for hedging or speculation. SFAS 133 was implemented in 2000 to require firms to report fair value of derivatives as opposed to notional value. However, firms still need to disclose their hedging activities with financial derivatives. Therefore the dichotomous measure of hedging fits our study. The data beyond 2000 are used in recent literature: Beatty, Petacchi and Zhang (2012), Campello et al. (2011), Gay, Lin and Smith (2010), and Carter, Rogers and Simkins (2006).

purpose of hedging during that year, and zero otherwise. The dummy variable is an effective measure of corporate hedging given the nature of our sample. By adopting this measure, we are able to examine over a long period of time the hedging activities of a large sample of U.S. companies, which is more comprehensive than the cross-sectional or single-industry samples used in the literature. In this study, we investigate three types of derivatives: foreign currency derivatives (FCDs), interest rate derivatives (IRDs), and commodity derivatives (CDs). These instruments are most commonly used for hedging by non-financial U.S. firms. Géczy, Minton, and Schrand (1997) summarize the use of derivatives for a sample of Fortune 500 non-financial firms in 1993 and find that currency derivatives are used most frequently by corporation (52.1%), followed by interest rate derivatives (44.2%), and commodity derivatives (11.3%). For a given firm-year observation of financial and hedging information in year *t*, we require that there is at least one bond transaction in year *t+1* in order to estimate a valid cost of debt. After filtering out firm-year observations without valid cost of debt estimates, we arrive at the sample of 2,612 firms and 13,066 bond issues.

1.3.2 Cost of Debt

Following Klock, Mansi, and Maxwell (2005) and Cremers, Nair, and Wei (2007), we use yield spread as the measure for cost of debt. Yield spread is defined as the difference in yield between the corporate and Treasury bonds matched by modified duration. For each bond transaction, we calculate yield to maturity using the trading price, maturity date, trading date, and coupon rate. We then identify all Treasury securities that have modified duration within two months of that of the corporate bond. The Treasury security closest in modified duration to the corporate bond is selected as the matched pair. In addition to modified duration matching, we employ three additional matching methods: Macaulay duration matching, maturity matching, and maturity matching based on the Treasury constant maturity rates and interpolation methodology. Yield spreads estimated

from these four methods are qualitatively similar. Yield spreads based on modified duration matching are used in the analyses throughout the study.[7]

For a given bond in a given year, we calculate the weighted average of yield spreads across all transactions, using transaction volume as the weight. For robustness checks, we use alternative averaging methods to obtain the bond-level yield spread in a given year: simple average of yield spreads across all transactions, simple average of yield spreads of the last trade at the end of each quarter, and yield spread of the last trade of the year. Bond-level yield spreads calculated using the alternative methods are generally similar to those based on transaction volume weights. Finally, at the firm-year level, we compute the weighted average of the bond-level yield spreads using the amount outstanding as the weight.

1.3.3 Descriptive Statistics of Hedging and the Cost of Debt

Based on the sample of 2,612 firms and 13,066 bonds, we examine the hedging behavior and its impacts on the cost of debt from 1994 to 2009. Table 1 provides an overview of various hedging activities by industry and time period. Panel A shows the number and percentage of sample firms and bond issues by industry. We use the first 2 digits of the SIC code to group firms into nine industry categories. Generally, Manufacturing (1,089 firms and 41.7% of the sample) and Transportation, Communications and Utilities (622 firms and 23.8%) are the two largest industry groups in our sample. Not surprisingly, these two industry groups are also the ones with the most bond issues: 4,493 bonds (34.4% of the sample) for Manufacturing and 4,865 bonds (37.2%) for Transportation, Communications and Utilities. We next describe the hedging behaviors of sample firms by industry and year. In particular, Panel B reports the number and percentage of firm-year observations in which the firm hedges with at least one type

[7] The results using the other matching methods are available upon request.

of hedging instruments (FCDs, IRDs, or CDs), and those in which the firm hedges with FCDs, IRDs, and CDs, respectively. With the exception of the Agriculture and Retail industries, the percentage of firm-year observations marked as hedging with at least one instrument is similar across industry groups at 40% to 50%. Retail firms are least likely to hedge, with 17.9% (216 out of 1,206) of firm-year observations marked as hedging. On the other hand, hedging is prevalent in the agricultural industry with 79.5% of firm-year observations marked as hedging. This is not surprising due to the nature of the industry. When examining hedging using FCDs, IRDs, and CDs individually, we find a few interesting results. First, Manufacturing firms use FCDs and IRDs as their main hedging vehicles, while the other industries rely mostly on IRDs. Second, it is not surprising that mining firms and agricultural firms use CDs more frequently (33.1% and 25.6%) than firms in the other industries. Transportation, Communications and Utilities firms are also found to have a sizable amount of hedging using CDs (19.1%). Panel C shows how hedging behavior changes over time. We divide the sample into three five-year periods and find that hedging is employed more frequently over time, growing from 40.0% in the 1994 to 1999 period to 53.6% in the 2000 to 2004 period, and to 59.1% in the 2005 to 2006 period. Note that the dip in hedging in 2007 to 2009 corresponds to the start of the financial crisis.

Table 2 presents bond characteristics and yield spreads. Panel A shows the descriptive statistics of coupon rate, issue size, maturity, credit rating, and embedded option including convertibility, callability and putability. The sample bonds on average have a coupon rate of 7.09%, an issue size of $285.10 million, and a maturity of 13.10 years. We use Moody's ratings and follow the conversion process from Klock, Mansi, and Maxwell (2005) to assign numbers to rating categories as follows: a value of 22 for Aaa rated bonds, 21 for Aa1 rated bonds, ..., and 1 for D rated bonds. Credit rating has an average (median) of 11.67 (13.00), which corresponds to a Ba2 (Baa3) rating. We also

find the majority (73%) of the sample bonds are callable. Lastly, convertible bonds account for 14% of the sample, while putable bonds represent a small portion of the sample, accounting for 7%. To provide an initial view of yield spreads, we report the descriptive statistics of yield spreads at the transaction level in Panel B of Table 2. Based on 11,448,121 bond transactions, we find that yield spreads range from -5.41% to 13.48%, and have a mean and median of 3.67% and 3.18% respectively. The distribution of yield spreads is generally consistent with what has been observed in the corporate bond market.

1.4 Empirical Results

1.4.1 Hedging and the Cost of Debt

In this paper, we study the relationship between corporate hedging policy and the cost of debt, and the hypotheses that support this relationship. To do so, we first present yield spreads by hedging and further by various firm characteristics. To incorporate firm characteristics in the analysis, we require firms to have financial information in COMPUSTAT and stock prices in CRSP. After deleting observations with missing financial information and stock prices, we arrive at the final sample of 1,832 firms and 10,757 firm-year observations. Recall that at the firm-year level, we compute the weighted average of the bond-level yield spreads using amount outstanding as the weight. Hedging is a dummy variable that takes a value of one when the firm holds or trades at least one of the three types of derivatives for hedging purposes in a given year, and zero otherwise. Panel A of Table 3 shows the yield spread by hedging behavior for the full sample. We find that the mean (median) yield spread is 3.356% (2.790%) for hedgers and 3.847% (3.232%) for non-hedgers. The difference in mean (median) between the two groups is 49.1 (44.2) bps, which is significant at the 1% level. This difference is economically significant and suggests that hedging leads to a large reduction in the cost of debt. Our findings are consistent with that of Campello et al. (2011), who find a difference of 31.2 bps in loan spread between hedgers and non-hedgers.

We further divide the sample into groups based on various firm characteristics to investigate how hedging affects the cost of debt. According to Section 2.3, a set of proxies are developed to test each of the three hypotheses. Definitions of these firm variables are summarized in the Appendix. The first set of proxies is used to examine the bankruptcy risk hypothesis. In particular, we use credit rating, leverage, interest coverage ratio, and Altman's Z-score as measures of bankruptcy risk. The full sample columns of Panel B presents yield spreads by credit rating. The mean (median) yield spread is 4.311% (4.055%) for the speculative grade firms, which is significantly larger than 2.297% (2.015%) for the investment grade firms. We further report yield spreads by credit rating for the hedging and non-hedging groups respectively. For both speculative- and investment-grade subsamples, hedgers pay a significantly lower cost of debt than non-hedgers: average yield spread drops from 4.538% to 4.086% for the speculative-grade firms and from 2.408% to 2.215% for the investment-grade firms. Importantly, hedging has a stronger effect on the cost of debt for the speculative grade issuers than the investment grade issuers. The mean difference in yield spreads between hedging and non-hedging firms is 45.2 bps for speculative-grade issuers, and 19.2 bps for investment-grade firms.[8] The significantly larger reduction in the cost of debt for speculative-grade issuers is consistent with the intuition that hedging is more beneficial to firms with greater financial risk. Panels C through E present findings that are consistent with those in Panel B. Specifically, yield spread is larger for firms that have a higher leverage, a lower interest coverage or a lower Altman's Z-score. Furthermore, the difference in the cost of debt between hedgers and non-hedgers is larger for the subsamples with higher default risk.

[8] Note that the difference in mean for full sample (49.1 bps) is greater than the difference in mean for both two sub-samples (19.2 bps and 45.2 bps). The reason is that mathematically the range of weighted average for full sample and sub-samples depends on both values and weights. A simple example is available upon request.

To examine the agency cost hypothesis, we use sales growth, convertible, and the risk-shifting index as proxies for the severity of agency problems. At the firm level, we calculate the weighted average of bond-level risk-shifting indices using the amount outstanding as the weight. Bondholders are subject to the most (least) severe risk-shifting problem when the index equals one (zero). Panels F through H report the yield spread by each of the three agency cost proxies, respectively. In Panel F, we find that the cost of debt for the high-growth firms (3.848%) is significantly higher than that for the low-growth firms (3.327%). More interestingly, hedging firms pay a lower cost of debt than non-hedgers regardless of the grouping by growth. The difference in cost of debt between hedgers and non-hedgers is 39.6 bps for the low-growth subsample and 57.2 bps for high-growth. This is in line with the prediction that high-growth firms, which are likely to have more severe risk-shifting problems, would enjoy a larger reduction in the cost of debt than low-growth firms. Furthermore, Panels G and H results suggest that firms with bonds containing the conversion option or multiple restrictive covenants (a low risk-shifting index) enjoy a lower cost on debt than those without. Similarly, hedgers have a lower cost of debt than non-hedgers. Interestingly, only the result based on convertibility (Panel G) suggests that hedging leads to a significantly larger reduction in the cost of debt for firms with more severe agency problems.

The remaining panels present the results for the information asymmetry hypothesis. Using the forecast accuracy and dispersion in analysts' earnings forecast, DaDalt, Gay, and Nam (2002) find that the use of derivatives is associated with lower asymmetric information. We follow their method and use the forecast of earnings per share (EPS) in the 3-month period prior to the fiscal year end to construct the first two measures of information asymmetry: normalized forecast error and forecast dispersion.[9]

[9] We also try forecasts made in 6-month and 12-month periods prior to fiscal year end to calculate these two measures and do not find qualitatively different results. We report the results based on the 3-month window forecasts since a 6-month or 12-month window is more likely to contain noise. In addition, the 3-month window prior to the end of fiscal year corresponds to the information disclosure from the last

In addition, we use accounting accruals as an alternative measure of information asymmetry. Accounting accruals contribute to information asymmetry between managers and outside investors by allowing managers to exercise discretion on accruals to manipulate financial statements. Teoh, Welch, and Wong (1988) suggest that firms with positive accruals are characterized with more earnings inflation and opacity of cash flows. Sufi (2007) uses the same measure and argues that lenders tend to use more concentrated syndicated loans to closely monitor firms with positive accounting accruals. Therefore, positive accounting accruals serve as a valid proxy for information asymmetry. From the full sample columns of Panels I, J, and K, we find that firms pay a higher cost of debt in the group of high normalized forecast error (3.913% vs. 2.566%), in the group of high forecast dispersion (3.581% vs. 2.617%), and in the group of positive accounting accruals (4.039% vs. 3.471%). These findings are intuitive because opaque firms pay a higher cost of debt to cover the "transparency spread" demanded by bondholders. Firms that hedge have a lower cost of debt than firms that do not. More importantly, hedging has a significantly larger impact on the cost of debt for firms with a high level of information asymmetry than those with a low level of information asymmetry. For example, Panel K shows that the difference in cost of debt between hedgers and non-hedgers is 89.0 bps for firms with positive accounting accruals (high information asymmetry) and 36.2 bps for firms with non-positive accruals (low information asymmetry). To sum up, the univariate results are supportive of the information asymmetry hypothesis.

1.4.2 Multivariate Analysis of Yield Spreads and Hedging

To examine the relationship between hedging and the cost of debt, we use multivariate regression models of yield spread with the hedging dummy as the main explanatory variable. In addition to hedging, we use three groups of explanatory variables suggested by the literature: firm-specific factors, bond characteristics, and market

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10-Q report, which is the most recent public information source for analysts to update their forecasts of annual earnings.

systematic risk factors. Variable definitions are summarized in the Appendix. Structural models of bond pricing imply the following firm-level characteristics for yield spreads: credit risk, profitability, and asset risk (e.g., Collin-Dufresne, Goldstein and Martin (2001), and Longstaff and Schwartz (1995)). For each characteristic, we use one or multiple firm variables as proxies. First, we use three proxies to measure credit risk: leverage, interest coverage, and Altman's Z-score. These variables are also used to test the bankruptcy risk hypothesis. A higher leverage, lower interest coverage or a lower Altman's Z-score is associated with a higher probability of default. Therefore, leverage should be positively related with the cost of debt, while interest coverage and Altman's Z-score are negatively related with the cost of debt. Second, we expect profitability to be negatively related to yield spreads. We measure growth opportunity by the market-to-book ratio. Theory suggests that market-to-book ratio is positively related to the cost of capital because agency problems are most severe for firms with high growth opportunities. However, empirical results are mixed (Campello et al. (2011) and Graham, Li, and Qiu (2008)). Third, we use earnings or asset return volatility to proxy for asset risk. We expect earnings volatility and asset return volatility to have a positive effect on yield spreads. Finally, we include firm size and private debt ratio as control variables.

For bond characteristics, we include credit rating, bond age, coupon, modified duration, and convexity (e.g., King and Khang (2005) and Klock, Mansi, and Maxwell (2005)). We also use two dummy variables to control for embedded options in bond contracts: convertible and callable.[10] Moody's ratings for individual bonds are collected from FISD and converted into numbers to measure credit risk. The conversion process is described in Section 3.3. Coupon is a proxy for tax-related benefits. Modified duration and convexity are included to control for the nonlinear relation between yield spreads and

[10] We disregard the put feature because putable bonds account for a very small fraction (7%) of our sample.

the term structure of interest rates. Convertibility and callability are valuable options and should be reflected in corporate yield spreads.

To control for systematic risks in the bond market, we include the market credit premium, level and slope of interest rates, and the Fama and French factors (King and Khang (2005), Klock, Mansi, and Maxwell (2005), and Campbell and Taksler (2003)). We expect yield spreads to be positively related to market credit premium, particularly during the bearish market. To consider the effect of the term structure on yield spreads, we include the level and slope of interest rates. Longstaff and Schwartz (1995) and Campbell and Taksler (2003) suggest a negative relationship between corporate and Treasury bond yields. However, Duffee (1998) argue that the empirical relationship between Treasury and corporate bond yield spreads can be the opposite to offset the increased tax wedge between these securities. Collin-Dufresne, Goldstein, and Martin (2001) suggest that the slope of the term structure should be negatively related to corporate yield spreads since the slope reflects the expected future spot rate, the increase of which deflates yield spreads. On the other hand, Avramov, Jostova, and Philipov (2007) suggest that a steeper slope is associated with an increase in corporate bond spreads because a higher expected future interest rate may imply a lower expected value of firm assets, resulting in a higher yield required by bondholders. We use the equity market premium, SMB and HML to control for the effects of equity market systematic factors on bond yields. Campbell and Taksler (2003) suggest that these factors have a strong explanatory power for corporate yield spreads.[11]

Table 4 reports the summary statistics of all variables used in the regressions. We find that the average cost of debt is 3.59% and hedging behavior appears in 53% of the firm-year observations. Our results are consistent with Campello et al. (2011). They report that 50% of firms in their private loan sample use hedging of FCDs and IRDs.

[11] Corporate and Treasury rates are from the Federal Reserve Bank at St. Louis. Fama and French's three factors are from Kenneth French's website at Dartmouth College.

Sample firms on average have a moderate level of leverage ratio of 25.85% and a healthy interest coverage ratio of 9.18. Altman's Z-score has an average of 2.08 and median of 1.99, which is in the “Grey” zone. Altman (1968) defines the area between 1.81 and 2.99 as “gray area” or “zone of ignorance”. Firms with scores in this category are possibly "temporarily sick", although without immediate risk of bankruptcy. The average firm in the sample has market-to-book ratio of 1.65 and profitability of 12.51%. In addition, firms have relatively low earnings volatility with a mean of 3.43% and asset return volatility with a mean of 8.71%. Private debt ratio has a median of 8.97% and a mean of 13.04%. Considering the median leverage ratio of 22.56%, public debt accounts for a large and significant portion in the sample firms' debt structure. On average, firms have a sales growth of 4.21% and 2 out of 5 restrictive covenants on bond contracts. Additionally we find that 21% of our sample firms have positive accruals. Firms have an average credit rating of 9.34, which is equivalent to the B1/Ba3 rating. Call option is broadly used (86%) in bond contracts, and convertibility provision is found in 31% of bond issuances. All market systematic factors are annualized. The premiums on the market risk factors are consistent with the current literature. We use the Fama-French industry categories to create industry dummy variables, which are included for industry effects.

1.4.3 Baseline Multivariate Regressions

Our multivariate regression model is structured as Equation (1.1) below:

$$\text{Yield Spread} = \alpha + \beta_1 \times \text{Hedging} + \beta_2 \times \text{Leverage} + \beta_3 \times \text{Interest Coverage} + \beta_4 \times \text{Altman's Z-score} + \beta_5 \times \text{Market-to-book} + \beta_6 \times \text{Profitability} + \beta_7 \times \text{Earnings Volatility} + \beta_8 \times \text{Firm Size} + \beta_9 \times \text{Private Debt Ratio} + \beta_{10} \times \text{Credit Rating} + \beta_{11} \times \text{Bond Age} + \beta_{12} \times \text{Coupon} + \beta_{13} \times \text{Modified Duration} + \beta_{14} \times \text{Convexity} + \beta_{15} \times \text{Convertible} + \beta_{16} \times \text{Callable} + \beta_{17} \times \text{Market Credit Premium} + \beta_{18} \times \text{Interest Rate Level} + \beta_{19} \times \text{Slope} + \beta_{20} \times \text{Equity Market Premium} + \beta_{21} \times \text{SMB} + \beta_{22} \times \text{HML} + \text{Industry Dummies} + \text{Year Dummies} + \varepsilon \quad (1.1)$$

Panel A of Table 5 provides the results of two models using the pooled OLS (POLS) regression method. Following Klock, Mansi and Maxwell (2005), we employ the Newey-West standard errors for robustness of heteroskedasticity and serial correlation. In the first column, we specify the predicted signs of the coefficients on various determinants. We find a significantly negative relationship between hedging and yield spreads in both models. Model 1 result indicates that hedging leads to a reduction of 40.8 bps in the cost of debt. After controlling for market credit premium, term structure and equity market factors in model 2, we find that hedging continues to result in a significant drop of 24.1 bps in the cost of debt. Based on the average cost of debt (3.59%) and average bond size ($925 million), a drop of 24.1 bps equals an annual saving of $2.23 million (= $925 million × 0.00241) in the cost of debt for a typical firm in our sample.

For firm-specific variables, we find that coefficients of leverage, interest coverage, and Altman's Z-score are consistent with the predictions of the structural model of bond pricing. High leverage, low interest coverage, or low Altman's Z-score represents a high probability of default in debt repayment and therefore leads to a large yield spread (King and Khang (2005)). In model 1, growth opportunity measured by market-to-book ratio is negatively related to the cost of debt, which is consistent with Campello et al. (2011). This result can be explained by the argument that firms with a high market value have more claimable assets over book assets to creditors in case of default. Interestingly, the coefficient on growth opportunity in model 2 is insignificant, which could be a result of competing explanations for the relationship between market-to-book ratio and bondholder value (Graham, Li, and Qiu (2008)). As the proxy for growth opportunity, market-to-book ratio is expected to be positively related to cost of debt since firms with more growth options have greater latitude in shifting their investments toward riskier assets. On the other hand, firms with a high market-to-book ratio are able to provide an additional value over book assets that bondholders can claim in the case of default. This

"financial cushion" leads to a lower cost of debt. Profitability and firm size have a negative and significant effect on yield spreads, which is consistent with Klock, Mansi, and Maxwell (2005). In other words, bondholders demand a lower lending cost to those firms with a higher potential cash stream or a larger firm size. Earnings volatility is positively related to yield spreads, indicating that the issuers' operational risk is priced in the cost of debt. We also used asset return volatility as an alternative measure (not reported) and the result remains the same. Finally, public bondholders require a higher cost of debt when the firms have a higher private debt ratio.

For bond-level variables, we find results that are generally consistent with prior literature. In particular, a better credit rating or a smaller coupon rate is associated with a lower yield spread. We find that modified duration (convexity) is negatively (positively) associated with yield spreads, which is found in Klock, Mansi, and Maxwell (2005). We use bond age as a measure of bond liquidity and expect to find a positive relation as older bonds usually carry a higher liquidity risk. Interestingly, we find that the effect of bond age is rather mixed. Our finding may be explained by the fact that bond age is a weighted average of that of individual bonds. Convertible bonds have lower yield spreads while callable bonds have higher spreads, both consistent with our expectations based on the nature of these options and the bond pricing theories.

Longstaff and Schwartz (1995) suggest a negative relationship between yield spread and the level of interest rate, which is explained by a positive impact of the increased interest rate on the drift of the risk-neutral process of firm value. Consistent with their prediction, we document a negative relation. For the slope of term structure we observe a positive impact on yield spreads. Empirical studies report mixed results on the effect of slope on corporate yields. Campbell and Taksler (2003) find a significantly negative impact, while Duffee (1998) and Collin-Dufresne, Goldstein, and Martin (2001) find insignificant or mixed effects. On the other hand, Avramov, Jostova, and Philipov

(2007) and Hibbert, Pavlova, and Dandapani (2011) report significantly positive effects. King and Khang (2005) argue that default-related variables (leverage, asset volatility, and rating) exhibit a greater explanatory power than systematic factors. Nonetheless, we find that default-related and systematic factors are both significant determinants of yield spreads. Finally, from the POLS regressions we find that the model explanatory power, measured by the adjusted R-squared, substantially increases after systematic risk factors are added. The adjusted R-squared increases from 0.547 in model 1 to 0.7 in model 2.

Panel B of Table 5 reports the model 2 POLS regressions by credit quality. Similar to those in the full sample shown in Panel A, we find negative impacts of hedging on yield spreads for both investment grade and speculative grade issuers. It is important to highlight that the negative impact is more pronounced for speculative grade issuers. Hedging leads to a decline of 26.6 bps in yield spread for speculative issuers compared to a drop of 12.9 bps for investment grade issuers. This finding is intuitive since speculative-grade firms are likely to enjoy a larger marginal benefit from a reduction in the risk of financial distress. In addition, we find that default-related determinants show more significant impacts on yield spreads for speculative grade than for investment grade issuers. For instance, the coefficient of Altman's Z-score is negative and significant for speculative grade issuers, but insignificant for investment grade issuers. Similar implications can be found in the impacts of profitability and earnings volatility. Moreover, we find that slope has a more significant impact on yield spreads for speculative grade (a coefficient of 1.448) than for investment grade firms (a coefficient of 0.947). This is consistent with the argument by Collin-Dufresne, Goldstein, and Martin (2001) that the term structure of credit spreads for speculative bonds has a steeper slope than that for investment grade bonds.

As indicated in Section 2.1, most of the hedging literature is based on firms within a single industry such as gold mining (Tufano (1996)), oil and gas (Jin and Jorion (2006)),

and airline (Carter, Rogers, and Simkins (2006)). The advantage of using the single-industry analysis is that this method can avoid the heterogeneous characteristics in hedging behavior among different industries. We recognize that this argument has merit and our results in Table 1 indicate differences in hedging behavior across industries. In addition to the difference in the tendency to hedge, we also observe that the types of derivatives used vary among industries. Certain industries prefer CDs, while others use IRDs or FCDs. Using the baseline model in Equation (1), we consider the heterogeneity in hedging behavior among industries. Specifically, we divide the full sample into seven industry groups by SIC codes: Agriculture, Mining and Construction (one-digit SIC code of 0 or 1), Manufacturing (one-digit SIC code of 2 or 3), Transportation (two-digit SIC code of 40 through 47), Communications and Utilities (two-digit SIC code of 48 or 49), Wholesales and Retails (one-digit SIC of 5), and Services and Public Administration (one-digit SIC code of 7 through 9). In addition, to provide a direct comparison to prior studies based on the oil and gas industry, we select the oil and gas extraction firms (two-digit SIC code of 13) and petroleum refining and related firms (two-digit SIC code of 29) to form the Oil and Gas industry group. We report model 2 regression results in Panel A of Table 6. The findings suggest that in all industry categories except for services and public administration, hedging has a significant and negative effect on yield spreads. For example, hedgers in the transportation industry pay 43.2 bps lower in the cost of debt than non-hedgers, while hedging results in a 38.7 bps reduction in the cost of debt for oil and gas companies.

To explore the possibility that only firms that are exposed to relevant ex ante risk exposures should hedge, we examine the hedging impact on cost of debt conditioned upon relevant ex ante risk exposures. In other words, we examine hedging using currency derivatives for firms that are exposed to currency risk, hedging using interest rate derivatives for firms that are exposed to interest rate risk, and hedging using

commodity derivatives for firms that are exposed to commodity risk. We follow the methodology used in Graham and Rogers (2002) and Campello et al. (2011) to identify the ex ante risk exposures, and study the relation between specific hedging strategies and cost of debt by applying the baseline model for each subsample of firms with identified ex ante risk exposures.[12] The results reported in Panel B of Table 6 show a strong and negative relation between the cost of debt and each of the three types of hedging strategies. For firms with interest rate risk exposure, interest rate hedging helps reduce 24.5 bps in the cost of debt. Similarly, the reductions in the cost of debt from hedging against currency risk and commodity risk are economically and statistically significant (10.4 bps and 20.4 bps).[13]

As a natural experiment as to how hedging policy affects the cost of debt, we explore the cross-sectional difference in the consequence of a change in hedging policy by examining those firms that initiate hedging and those that suspend hedging during the sample period. In particular, 136 firms are found to initiate hedging and 352 firms are found to suspend hedging. Hedging initiation firms exhibit no hedging behavior from the start of the sample period (1993), initiate hedging some time during the sample period, and maintain their hedging activities until the end (2008). Hedging suspension firms have the opposite time series pattern to that of the hedging initiation firms. For each hedging

[12] We follow Zhu (2012) and Chiang et al. (2013) to identify a firm exposed to commodity risk when the its 2-digit SIC code falls in the categories: 13, 21, 22, 24, 25, 26, 29, 33, 34, 37, 45, or its 4-digit SIC is 5172. Consistent with the literature, we find that a very small portion of the sample (1.04% or 112 firm-years in our sample, 5.8% in Campello et al. (2011), and 3.1% in Graham and Rogers (2002)) is not associated with any ex ante risk exposures. Our results remain unchanged if we exclude these 112 observations. Due to the potential limitations of the identification methods (see footnote 11 and 12 in Graham and Rogers (2002)) and the discussion in Smith (2008) that commodity, foreign currency, and interest rate risks are essentially market-wide risks, we keep all 10,757 firm-years in our analysis.

[13] We acknowledge that issuers exposed to interest rate risk may use call feature embedded in the bonds to protect them from an increase in interest rate. Therefore for the sample with ex ante interest rate risk, we use two ways to examine this possibility. First, using two-stage regressions, we regress the interest rate hedging dummy on the callable dummy and other determinants in the first stage, and use the predicated hedging to test its impact on the cost of debt in the second stage. The first-stage result fails to support callable option as a substitute for hedging strategy. In the second-stage regression, the predicated hedging has a significant and negative impact on cost of debt. Second, we perform the OLS regression on a subsample of callable bonds and find hedging still leads to a significant reduction in the cost of debt.

initiation (suspension) firm at the time of change, we find a matching firm by applying the propensity score matching (PSM) procedure and requiring that matching firms remain the status of non-hedging (hedging) for hedging initiation (suspension) firms throughout the sample period. In our context, a propensity score is the probability that a firm adopts hedging strategy conditional on the determinants documented in literature. A probit model of hedging dummy is used first to estimate the propensity score, and each firm in the initiation or suspension sample is paired with a matching firm by the closest propensity score ("nearest neighborhood" matching).[14]

To examine if hedging initiations and suspensions lead to a significant change in yield spreads, we employ model 2 of the base case regressions and run the following two regressions. In the first regression, we use the 136 pairs of hedging initiation and their matches (272 firms) and replace the hedging dummy with the hedging initiation dummy. The hedging initiation dummy equals one if a given firm initiates hedging in year *t*, and zero otherwise. We use the 352 pairs of hedging suspension firms and their matches in the second regression. The hedging dummy is replaced with the hedging suspension dummy that equals one if a given firm suspends hedging in year *t*, and zero otherwise. We use change in yield spread around the change in hedging policy as a direct measure of the hedging impact. More specifically, for each initiation (suspension) firm we calculate the difference in yield spread between year *t* and *t-1*, where year *t* is the year when a given firm initiates (suspends) hedging. We follow the same procedure to calculate the change in yield spread for the matching firms. For example, firm A had no hedging activities from year 1993 to 1999, started to hedge from year 2000 onward. Year 2000 is the initiation year, i.e., year *t*. Change in yield spread equals the yield spread in 2000 minus that in 1999, and it is calculated for firm A and its matched pair, respectively. For

[14] The matching is calibrated by year with the replacement option and the matching rule "caliper (0.01) trim (1) common." Setting a maximum caliper at 20% of the standard deviation of the logarithmic propensity score will not change our results.

each of the other explanatory variables, we calculate the difference in level between year *t* and year *t-1*. The regression results are presented in Table 7. We observe a negative and significant coefficient (-0.392) on the hedging initiation dummy and a positive and significant coefficient (0.580) on the hedging suspension dummy. Around the time of change, hedging initiation firms enjoy a significantly larger drop in yield spread than their matching firms. In addition, hedging suspension firms experience a significantly greater jump in yield spread than their matches. The findings lend solid support for the hedging benefit in reducing the cost of debt.

1.4.4 Extended Multivariate Regressions

The POLS regression results demonstrate a significant effect of hedging on the cost of debt. To address the potential issue of model misspecifications and to capture the effect of time-varying firm characteristics, we apply a panel-data framework with fixed effects.[15] The model helps control for the unobserved heterogeneity, which is constant over time and correlates with the explanatory variables. In the first column of Table 8, we present model 2 regression with firm fixed effects to examine how hedging influences the cost of debt. The result shows that hedging reduces the cost of debt by 30 bps. Recall that in the full sample POLS regressions, hedging leads to a 24.1 bps drop in the cost of debt. In addition, the signs and significance of the coefficients on the main variables in the fixed effects model are very similar to those in the POLS estimation. Roberts and Whited (2012) point out the benefits of the fixed effects model as supported by econometric tests. They also suggest the inferences based on POLS remain valid given that the economic significance is the same in both models. Therefore, once the observed firm characteristics and fixed effects are controlled for, the evidence is in favor of our assertion that there is a strong negative link between hedging and the cost of debt.

[15] We also perform the random effect model and the result is very similar to that of the fixed effects model.

Investigations of topics in corporate finance are often vulnerable to the possibility of endogeneity.[16] In our research, the implication based on regressions might be subject to the bias from the impact of unobservable factors on hedging or from a reverse causality that firms with a higher cost of debt are more likely to hedge. Although panel data methods offer a partial solution, for additional robustness tests we implement an extensive set of methods used in existing literature to address the concerns of endogeneity. First, in the spirit of Chordia, Huh, and Subrahmanyam (2007), we use the one-year lagged measure of all explanatory variables. Trading in the public market promotes the efficiency of corporate bond prices in reflecting the firms' current performance. Compared to contemporaneous hedging, it is less likely for hedging in the previous year to correlate with the unobservable factors which might affect the cost of debt. The second column of Table 8 reports the regression result for testing such relation between yield spread and the lagged hedging dummy and all other independent variables. A negative and statistically significant effect of hedging on cost of debt is clearly strong.

In addition, we follow Allayannis, Lel, and Miller (2012) to employ the Heckman's treatment effect model. The treatment effect model is proposed to control for the self-selection bias. The treatment effect in our research, the decision to hedge, may be self-selected because of the benefits which trigger the incentive to hedge. In this case, the OLS estimates may be subject to the selection bias since the firms gaining benefits from hedging are more likely to hedge and the econometric assumption of random sampling is violated. As a result, in the treatment effect regression we model the hedging decision as a function of determinants suggested by prior literature, including an instrument, the before-mentioned firm-specific variables and systematic risk factors. The second stage uses the predicted values of hedging and estimates its impact on the cost of debt using the full maximum likelihood estimation. We also control for the other explanatory variables

[16] See Roberts and Whited (2012) for a comprehensive discussion of the methods used to address the endogeneity problems in empirical corporate finance.

as specified in Equation (1). Considering that propensity score matching reduces the selection bias and eliminates the "curse of dimensionality" when multiple characteristics are required for matching (Bartram et al., 2011), we also employ the propensity score matching procedure in our full sample and perform OLS regressions on the newly created sample, which consists of 5,679 pairs of hedging firm-years and non-hedging firm-years matched by nearest propensity score.[17] The results of the Heckman's treatment model and the propensity score matching are reported in the third and fourth column of Table 8 respectively. In the treatment model result, we find that hedging firms have significantly smaller cost of debt after controlling for the potential bias of self-selection. The result based on the propensity score matched pairs also provides consistent evidence. The significantly negative coefficient (-0.186) of hedging suggests that cost of debt of a hedger is 18.6 bps lower than a non-hedger conditioned on that the pair of these two firms have the same likelihood of hedging.

Furthermore, to address the potential issue of endogeneity due to omitted variables, we employ the instrumental variables (IV) regression. In particular, there may be unobservable factors that motivate a firm to hedge and also affect the cost of debt. Therefore, hedging dummy can be regarded as an endogenous variable. Allayannis, Lel, and Miller (2012) suggest that a standard way to mitigate such concern is the instrumental variables approach. In the IV regression, the first-stage regression is a linear prediction model of the hedging policy on all of the other independent variables in Equation (1), and the fitted value of hedging is used as a regressor in the second-stage yield spread regression.[18] We apply GMM in the two-stage regression to obtain efficient

[17] Propensity score matching procedure is similar to that in the analysis of cross-sectional difference in Section 4.3, but here it is conducted on full sample rather than only initiation and suspension subsamples.

[18] Angrist and Krueger (2001) suggest that, in the IV model with a dichotomous endogenous variable, the use of linear regressions in the first-stage generates consistent estimates for the second stage. They argue that it is not necessary and may even leads to misspecification to use a probit or logit model in the first stage.

estimators for heteroskedasticity. In particular, first stage of the IV model includes an instrument, the before-mentioned firm-specific, bond-level, and systematic risk variables.

In the second stage, we plug the fitted value of hedging into the yield spread regression shown in Equation (1) above. Roberts and Whited (2012) suggest that instrumental variables regression is only as good as the choice of instrumental variables. We select the instrument by considering both its relevance with hedging and irrelevance with yield spread. More specifically, the relevance rule requires a non-zero correlation between an instrument and the endogenous variable of hedging, and the irrelevance rule indicates that the selected instrument must not be correlated with the unobserved determinants of yield spread. Existing literature on hedging suggests that tax benefits are closely related to the decision to hedge. Géczy, Minton, and Schrand (1997) use tax loss carryforward as a proxy of tax benefits since tax loss carryforward creates a convex tax schedule. Graham and Smith (1999) argue that tax loss carryforward might not capture the entire tax saving incentive. They develop a model to estimate the convexity in the corporate tax function, which is a more precise measure of tax incentive based on a five-percent reduction in the volatility of taxable income. We apply their model to estimate tax convexity and use its lag as the instrument. Since hedging is expected to lower the volatility of taxable income, the convexity measure captures the incremental value in tax savings associated with hedging activities. The same instrument is also adopted by Campello et al. (2011). They state that tax convexity is a nonlinear function of taxable income, tax codes, and various tax credits. Therefore, this measure reflects the features of tax system and structure, and consequently contributes to the exogenous variations to isolate the unbiased impact of hedging on the cost of debt. Based on the above discussion, we select tax convexity as the instrument in the IV estimation model. As a robustness

check, we also use tax loss carryforward as an alternative instrument and find it to be less effective than tax convexity.[19]

Although we argue that hedging reduces the cost of debt, presumably, a firm bearing high cost of debt may have more incentive to hedge. Such reverse causality may cause spurious correlation between the two variables. To address this issue, we employ the simultaneous equations model. In the system of SEM regressions, yield spread is represented as a function of hedging and the other explanatory variables as specified above, while the decision to hedge is a function of a set of explanatory variables including yield spread. Therefore, hedging and yield spread are both endogenous variables. The model specification of SEM regression include two equations: yield spread equation and hedging equation. The yield spread equation is the same as Equation (1), and the hedging equation includes yield spread, tax convexity as the instrument, firm-specific variables, and systematic risk factors.

The results of the IV estimation and SEM regressions are reported in the fifth and sixth column of Table 8. Similarly, we confirm the negative and significant impact of hedging on the cost of debt. To verify if the IV model has an underidentification problem, we estimate the Kleibergen-Paap rank LM statistic to test the null hypothesis that the instrument is underidentified. The statistic is significantly different from zero at the 1% level, indicating that the model is not underidentified. Additionally, the Kleibergen-Paap rank Wald F statistic is greater than 10, rejecting the null hypothesis that the instrument is a weak instrument.[20] The results for the other independent variables are consistent with those in Table 5. Namely, leverage, earnings volatility, private debt ratio, coupon, convexity, callable, market credit premium, and SMB are positively related to yield

[19] When we use tax loss carryforward as an instrument, the Wald F statistic is lower than the critical value of 10. This suggests that tax loss carryforward is a weak instrument for the hedging equation.

[20] To address the issues of heteroskedastic or autocorrelated disturbances, Kleibergen and Paap (2006) develop under the robust GMM setting the Kleibergen-Paap rank LM and Kleibergen-Paap rank Wald F statistics to replace the Anderson LM and Cragg-Donald Wald F statistics.

spreads. On the other hand, interest coverage, Altman's Z-score, profitability, firm size, credit rating, modified duration, convertible, interest rate level, and equity market premium are negatively associated with yield spreads. Our robustness checks are consistent with those of the baseline models and further confirm the hedging impact on the cost of debt. More critically, the results from the robustness tests indicate that our inferences from the POLS results are not subject to endogeneity.

Wintoki, Linck, and Netter (2012) put forward a dynamic panel GMM model in their study of the relation between firm performance and governance. Hoechle et al. (2012) also use the dynamic panel GMM model in addition to the Heckman selection models in their examination of how diversification discount can be explained by poor corporate governance. The presence of dynamic and interactive endogeneity is of potential concern in that case. In our paper, we recognize a similar implication: current firm performance may affect both hedging activity and the cost of debt, which in turn influence the firm's future performance. By controlling for dynamic endogeneity and simultaneity, the dynamic panel GMM model allows us to scrutinize the causal effect between hedging and the cost of debt.[21] Considering the fact that the current yield spread is likely to be related to the yield spread in the previous year, we include the lagged yield spread as an additional explanatory variable. We implement two tests to verify the validity of the instruments. The Hansen test of overidentification shows we fail to reject the null hypothesis that all instruments are valid. In other words, there is no overidentification problem in our model. The difference-in-Hansen test of exogeneity shows that the instruments used are exogenous. Overall, the results of dynamic panel GMM model confirm that hedging leads to a lower cost of debt.

[21] Wintoki, Linck, and Netter (2012) suggest that the dynamic panel GMM is most suitable when firms' historical parameters function as compelling instruments for model identification. Although it is possible that past yield spreads have impacts on current hedging decision, current hedging policy is less likely to be driven by the past cost of debt due to the forward-looking nature of hedging. Therefore we believe that dynamic endogeneity is not severe in our study.

1.5 Sources of Hedging Benefit

In this section, we test the three hypotheses proposed in Section 2.3 to explore the sources of hedging benefit in reducing the cost of debt. For each proxy variable of interest, we form an interaction term of hedging and the proxy variable, and run the yield spread regressions on this interaction term, hedging variable and the other explanatory variables as specified in Equation (1) above. For the first hypothesis, we form an interaction term of hedging and the proxies for financial risk. We run the POLS and treatment effect model regressions by including this interaction term.[22] Panels A, B, and C of Table 9 report regression results in which we use credit rating, speculative grade dummy variable and financial leverage as the proxy of financial risk, respectively. In Panel A, we find a significantly positive coefficient of the interaction term of hedging and credit rating in all regressions. Coefficient of (Hedging × Credit Rating) is 0.014 in both models, suggesting that hedging provides 1.4 bps more in the reduction of the cost of debt when rating is downgraded with one minor category (e.g., from Aa1 to Aa2.). In Panel B we consider the difference between speculative and investment grade issuers. We create a dummy variable of speculative grade, which takes the value of one if the firm has a speculative grade rating, and zero otherwise. We find that the coefficient on the interaction term of hedging and speculative grade dummy is negative and significant at the 5% level in POLS and treatment model regressions. For example, in treatment model regression, firms with a speculative grade rating obtain 17.6 bps more in the reduction of the cost of debt due to hedging policy than investment grade firms. Similar results are found in Panel C in which we report the regressions including the interaction term of hedging and leverage. Firms with a high leverage ratio obtain a greater value from

[22] The hedging decision in interaction term is also modeled as a treatment variable. See Brown and Mergoupis (2011) for details about adjustments made for predicted values and estimates in the presence of interaction term on the treatment variable. As Beatty, Petacchi, and Zhang (2012) point out, given that all firm characteristics might be endogenously determined, the estimation of a high-dimensional model is a numerically infeasible task.

hedging than those with low leverage. To sum up, the results of the intersection term of hedging and proxies of financial risk support our conjecture that hedging leads to a lower cost of debt through reducing the risk of financial distress.

To test the agency cost hypothesis, we form an interaction term of hedging and the proxy for agency costs. Recall that we employ three proxies for agency costs: sales growth, convertible dummy variable, and the risk-shifting index. Panels A, B, and C of Table 10 reports the results when we use sales growth, convertible, and the risk-shifting index, respectively. We find that the coefficient of interaction term of hedging and the agency cost proxies is not significant across all models, while hedging has a strong and negative effect on the cost of debt. Notably, there is one interesting observation. Panel A shows that the coefficient of the intersection term of hedging and sales growth is negative across the models, although none are significant. However, we find that sales growth has a positive relationship with the cost of debt, suggesting that sales growth serves as an appropriate measure of agency costs. As noted above, market-to-book ratio reflects two competing effects on the cost of debt. Sales growth serves as a better measure of firm growth.[23] Overall, the results provide little support for the agency costs hypothesis that firms with more severe agency problems benefit more from hedging.

Finally, we test the hypothesis that hedging reduces information asymmetry between managers and bondholders, leading to a negative impact on the cost of debt. Panels A and B in Table 11 represents the results when we use two measures of information asymmetry based on analyst forecasts. For both measures, the intersection item has significantly negative effect on the cost of debt. The findings suggest that hedging contributes a larger drop in the cost of debt as information asymmetry increases. Given that bondholders charge a "transparency spread" for opaque firms, hedging reduces the level of information asymmetry and therefore lowers the required spread. For

[23] Growth in capital expenditure and growth in R&D expense are used as alternative measures of growth. The results are similar to those in which sales growth is used.

example, the POLS regression in Panel A suggests that a one percent increase in the normalized forecast error is associated with a 1.3 bps increase in the cost of debt. However, hedging helps reduce 0.7 bps, cancelling about half of the increase. We observe a similar pattern in Panel B when forecast dispersion is used. With a one percent increase in forecast dispersion, the cost of debt rises by 3.5 to 3.7 bps. The coefficient of intersection term implies that hedging firms pay 1.6 bps less for the transparency spread demanded by bondholders. We find similar support for the information asymmetry hypothesis in Panel C. First, the positive accruals dummy shows a significantly positive impact on the cost of debt, which is consistent with the literature that accounting opacity is associated with a high cost of capital. For example, the treatment model estimation results suggest that firms with positive accruals on average pay 43.3 bps more in the cost of debt than those without. Second, for firms with positive accruals, hedging helps reduce the “transparency spread" by 32.1 bps. Overall, we find strong support for the information asymmetry hypothesis that hedging leads to a drop in the cost of debt through the reduced information asymmetry.

1.6 Economic Value of Hedging

The existing literature establishes that hedging increases firm value. In the previous sections, we document that hedging reduces the cost of debt. A related question is whether the effect of hedging on the cost of debt creates significant economic value for a firm. In this section, we examine the impacts of hedging on corporate investments and firm value through the channel of lowering the cost of debt. In particular, capital expenditure represents one major corporate spending for the direct purpose of creating long-term profits, reflecting the motivation of firms to make investments for sustaining current operations and supporting future expansions. We adopt capital expenditure as a measure of firm investments. To gauge firm value, we use Tobin’s Q measured by the market to book ratio. Although the implication of this ratio is somewhat mixed, it is

commonly used in the literature to measure value creation (e.g., Allayannis, Lel, and Miller (2012) and Mackay and Moeller (2007)). Additionally, we follow the methodology developed in Faulkender and Wang (2006) to estimate the incremental value that the market incorporates from the change in cost of debt and hedging policy. In particular, we define excess stock return as the difference between firm *i*'s stock return from year *t-1* to year *t* and the Fama and French 25 size and book-to-market matched portfolio return from year *t-1* to year *t*.

In Panel A of Table 12, we report the POLS and treatment effect model regressions of capital expenditure scaled by the lagged total assets on yield spread, hedging, and the other control variables. Other things held constant, we expect a higher cost of debt leads to a lower capital expenditure. We also include an interaction item of yield spread and hedging to examine whether hedging mitigates the negative impact of cost of debt on capital expenditure. From both POLS and treatment model regressions, we first find a negative relation between yield spread and capital expenditure, suggesting that a higher cost of debt reduces firm investments. In addition, the coefficient on the interaction item of yield spread and hedging is positive and significant at the 5% level in both models. For example, the POLS regression suggests that a one percent increases in yield spread results in a drop of 9.4 bps in capital expenditure scaled by lagged total assets. However, the drop in capital expenditure is reduced by half due to hedging. Our finding supports the view that hedging reduces the cost of debt, and in turn causes a positive and significant impact on firm investments. We present the results for the analysis of Tobin's Q in Panel B. The dependent variable is the natural logarithm of market-to-book ratio. In both models, we find that a higher cost of debt leads to a lower Tobin's Q. The coefficient on yield spread is negative and significant at the 1% level in both regressions. The result is intuitive since firm value decreases as the cost of capital (in this case, the cost of debt) increases. In addition, we find that hedging is positively

related to Tobin's Q at the 1% level, which is consistent with the existing empirical findings that hedging creates value. Most importantly, the coefficient on the interaction item of hedging and yield spread is positive in both models and statistically significant at the 10% level in the treatment effect model. The finding provides evidence that hedging alleviates the negative effect of yield spread on firm value.

Finally, we examine the influence of hedging on excess stock return. We follow the methodology developed by Faulkender and Wang (2006) and apply it in the context of hedging and the cost of debt. The dependent variable is the excess equity return relative to the Fama and French's size and book-to-market matching portfolio. For explanatory variables, we include the hedging dummy variable, the change in yield spread, an interaction item of the change in yield spread and hedging, and the other control variables used in Faulkender and Wang (2006). In particular, we include the change in the following variables: cash and marketable securities, operating income, net assets, R&D expense, capital expenditure, common dividends, net financing, and firm leverage. Note that all control variables, except for firm leverage, are scaled by the lagged equity value to correspond with the excess equity return. Panel C reports the POLS model and treatment effect model results of excess equity return on change in yield spread, hedging, and the interacted term of these two. The results are strong and similar between the two models. For example, the POLS result suggests that a one percent increase in the cost of debt decreases the excess stock return by 1.264 percent. However, for hedgers, the negative effect of a higher cost of debt is reduced to 0.676 percent (= -1.264 percent + 0.588 percent). The result in treatment effect model provides further confirmation for our conjecture that hedging mitigates the negative impact of yield spread on excess stock returns.

1.7 Conclusion

We empirically examine the impact of hedging on the firms' cost of debt based on a large sample of U.S. firms from 1994 to 2009. We find that bond yield spread is significantly lower for those firms that hedge than those that do not hedge. The difference in yield spread between hedgers and non-hedgers is significant and ranges from 49.1 bps in the full sample, to 19.2 bps for investment-grade firms, and to 45.2 bps for the speculative-grade firms. The multivariate regressions confirm the negative relation between corporate hedging and the cost of debt. We find that the reduction in cost of debt is larger for speculative grade than for investment grade firms, and the hedging impact remains strong across industry groups. By examining hedging initiations and suspensions at the time of the change, we find that initiation firms experience a drop in the cost of debt and suspension firms bear a jump in the cost of debt. The extended multivariate models including firm fixed effect, lagged variables, Heckman treatment effect, propensity score matching, IV estimation, SEM, and Dynamic panel GMM provide strong support that the relation between hedging and the cost of debt is not driven by the possibility of model misspecification, time-varying firm characteristics, and endogeneity.

We find that hedging reduces the cost of debt mainly through the lessening of bankruptcy risk and the lowering of information asymmetry between managers and bondholders. Finally, we find that hedging creates an economic value by attenuating the negative impact of an increase in cost of debt on corporate investment, firm value, and excess stock return. To our knowledge this paper is the first study to examine the impact of hedging policy on the cost of public debt. Our findings contribute to the extant literature on the link between hedging and firm value by examining how hedging affects the cost of long-term debt capital, the sources of such benefit, and the economic value of hedging through the reduction in cost of debt on firm investment and value. Our study provides strong empirical support for the proposition that risk management is an

important corporate policy that leads to a significant reduction in the cost of capital and an increase in firm value.

Table 1.1: Sample firms and hedging behavior by industry and time period

Panel A reports the number and fraction of the sample of 2,612 firms and 13,066 bonds from 1994 through 2009 by industry. We adopt the 2-digit SIC code to form nine main industry categories. In Panel B, we report the uses of three types of hedging derivatives based on firm-year observations. Panel C shows the trend of hedging behaviors over time.

Panel A: Distribution of Sample Firms and Bond Issues by Industry

First 2-digit SIC Code	Industry Categories	The Number of Firms	The Percentage of Firm Observations	The Number of Bond Issues	The Percentage of Bond Observations
01-09	Agriculture, Forestry & Fishing	5	0.19%	26	0.20%
10-14	Mining	184	7.04%	768	5.88%
15-17	Construction	37	1.42%	220	1.68%
20-39	Manufacturing	1,089	41.69%	4,493	34.39%
40-49	Trans., Comm., & Utility	622	23.81%	4,865	37.23%
50-51	Wholesale Trade	88	3.37%	364	2.79%
52-59	Retail Trade	187	7.16%	869	6.65%
70-89	Services	393	15.05%	1,427	10.92%
91-99	Public Administration	7	0.27%	34	0.26%
Total		2,612	100.00%	13,066	100.00%

Panel B: Hedging Behavior by Industry

First 2-digit SIC Code	Industry Categories	Total	Any Hedging		Foreign Currency Hedging		Interest Rate Hedging		Commodity Hedging	
		N	N	%	N	%	N	%	N	%
01-09	Agriculture, Forestry & Fishing	39	31	79.5%	25	64.1%	22	56.4%	10	25.6%
10-14	Mining	1,065	574	53.9%	220	20.7%	423	39.7%	352	33.1%
15-17	Construction	284	119	41.9%	18	6.3%	107	37.7%	8	2.8%
20-39	Manufacturing	7,224	3,746	51.9%	2,805	38.8%	2,864	39.6%	816	11.3%
40-49	Trans., Comm., & Utility	4,457	2,124	47.7%	729	16.4%	1,865	41.8%	852	19.1%
50-51	Wholesale Trade	573	265	46.2%	166	29.0%	224	39.1%	50	8.7%
52-59	Retail Trade	1,206	216	17.9%	78	6.5%	176	14.6%	10	0.8%
70-89	Services	2,003	1,036	51.7%	472	23.6%	863	43.1%	51	2.5%
91-99	Public Administration	62	40	64.5%	35	56.5%	40	64.5%	5	8.1%
Total		16,913	8,151	48.2%	4,548	26.9%	6,584	38.9%	2,154	12.7%

Panel C: Hedging Behavior by Year

Time Periods	Total	Any Hedging		Foreign Currency Hedging		Interest Rate Hedging		Commodity Hedging	
	N	N	%	N	%	N	%	N	%
1994-1999	4,983	1,994	40.0%	1,193	23.9%	1,532	30.7%	350	7.0%
2000-2004	5,798	3,105	53.6%	1,683	29.0%	2,543	43.9%	866	14.9%
2005-2009	6,132	3,052	49.8%	1,672	27.3%	2,509	40.9%	938	15.3%
---2005-2006	2,617	1,546	59.1%	808	30.9%	1,289	49.3%	464	17.7%
---2007-2009	3,515	1,506	42.8%	864	24.6%	1,220	34.7%	474	13.5%
Total	16,913	8,151	48.2%	4,548	26.9%	6,584	38.9%	2,154	12.7%

Table 1.2: Sample bond characteristics and yield spreads on the transaction level

This table presents bond characteristics of the sample of 13,066 bonds issued by 2,612 firms. Panel A shows the cross-sectional characteristics of bonds. Coupon is the annual payment percent specified on the bond contract. Issue size is the value of bond contracts outstanding in millions of dollars. Maturity is the original bond maturity in years. Credit rating is defined using the conversion method used by Klock, Mansi, and Maxwell (2005): a value of 22 for Aaa rated bonds, 21 for Aa1 rated bonds, ..., and 1 for D rated bonds. Convertible, callable and putable are dummy variables for the corresponding options. Panel B shows the statistics of yield spreads based on 11,448,121 bond transactions of the 13,066 bonds. Yield spread (in percent) is computed as the yield difference between the corporate bond and the treasury match with the closest modified duration.

Panel A: Cross-sectional Characteristics of Bonds

	N	Mean	Median	S.D.	Min	Max
Coupon (%)	13,066	7.09	7.00	2.60	0.00	18.50
Issue Size (Million $)	13,066	285.10	200.00	241.40	23.25	1000.00
Maturity (Year)	13,066	13.10	10.00	10.18	0.56	100.10
Credit Rating	13,066	11.67	13.00	5.80	0.00	22.00
Convertible	13,066	0.14	0.00	0.35	0.00	1.00
Callable	13,066	0.73	1.00	0.45	0.00	1.00
Putable	13,066	0.07	0.00	0.25	0.00	1.00

Panel B: Yield Spread Based on Transactions

Basic Statistics	N	Mean	Median	S.D.	Min	Max	Skewness	Kurtosis
Yield Spread (%)	11,448,121	3.67	3.18	3.31	-5.41	13.48	0.93	4.10

Table 1.3: Yield spreads by hedging and firm characteristics

This table presents yield spreads by hedging and various firm characteristics. The sample covers 10,757 firm-years based on 1,832 firms from 1994 to 2009. Panel A shows the mean and median of yield spreads for the full sample. Panels B through E show the results by financial risk proxies (credit risk, leverage, interest coverage, and Altman's Z-score). Panels F through H show the results by agency cost proxies (sales growth, convertible bonds, and the risk-shifting index). Panels I through K show the results by information asymmetry proxies (normalized forecast error, forecast dispersion and accounting accruals).

Grouping	Full Sample			Hedging			Non-hedging			Difference
Indicator	Mean	Median	N	Mean	Median	N	Mean	Median	N	in Mean
Panel A: Full Sample										
	3.588	2.981	10,757	3.356	2.790	5,679	3.847	3.232	5,078	-0.491***
Panel B: Credit Rating										
Speculative Grade	4.311	4.055	6,894	4.086	3.797	3,463	4.538	4.262	3,431	-0.452***
Investment Grade	2.297	2.015	3,863	2.215	1.939	2,216	2.408	2.103	1,647	-0.192***
Difference	2.013***	2.040***		1.870***	1.858***		2.130***	2.159***		-0.260**
Panel C: Leverage										
Below Median	2.361	2.002	5,378	2.256	1.926	2,867	2.482	2.117	2,511	-0.227***
Above Median	4.814	4.289	5,379	4.478	3.962	2,812	5.182	4.628	2,567	-0.704***
Difference	-2.452***	-2.287***		-2.222***	-2.036***		-2.700***	-2.511***		0.478***
Panel D: Interest Coverage										
Below Median	4.835	4.282	5,375	4.563	4.051	2,826	5.136	4.547	2,549	-0.573***
Above Median	2.342	2.055	5,382	2.160	1.924	2,853	2.548	2.241	2,529	-0.388***
Difference	2.493***	2.227***		2.404***	2.127***		2.588***	2.306***		-0.185
Panel E: Altman's Z-score										
Below Median	4.418	3.829	5,379	4.168	3.588	2,920	4.714	4.101	2,459	-0.546***
Above Median	2.758	2.315	5,378	2.496	2.116	2,759	3.033	2.561	2,619	-0.537***
Difference	1.660***	1.514***		1.672***	1.472***		1.681***	1.540***		-0.009
Panel F: Sales Growth										
Below Median	3.327	2.844	5,374	3.142	2.706	2,874	3.538	3.016	2,500	-0.396***
Above Median	3.848	3.127	5,383	3.575	2.859	2,805	4.146	3.455	2,578	-0.572***
Difference	-0.522***	-0.283***		-0.432***	-0.153***		-0.608***	-0.440***		0.176
Panel G: Convertible Bonds										
Non-Convertible Bonds	4.078	3.384	7,453	3.768	3.089	4,125	4.461	3.761	3,328	-0.693***
Convertible Bonds	2.482	1.763	3,304	2.261	1.540	1,554	2.678	1.950	1,750	-0.417***
Difference	1.595***	1.621***		1.507***	1.549***		1.783***	1.811***		-0.276**
Panel H: Risk-shifting Index										
Below Median	3.386	2.777	5377	3.146	2.566	2812	3.650	3.042	2565	-0.504***
Above Median	3.789	3.219	5380	3.561	3.041	2867	4.048	3.451	2513	-0.487***
Difference	-0.402***	-0.442***		-0.415***	-0.475***		-0.398***	-0.409***		-0.017
Panel I: Normalized Forecasts Error										
Below Median	2.566	2.207	4,467	2.519	2.146	2,570	2.631	2.290	1,897	-0.112*
Above Median	3.913	3.443	4,474	3.651	3.215	2,385	4.212	3.725	2,089	-0.561***
Difference	-1.346***	-1.236***		-1.132***	-1.069***		-1.581***	-1.436***		0.449***
Panel J: Forecasts Dispersion										
Below Median	2.617	2.245	4,137	2.535	2.153	2,226	2.712	2.319	1,911	-0.177**
Above Median	3.581	3.054	4,415	3.332	2.870	2,552	3.922	3.364	1,863	-0.590***
Difference	-0.964***	-0.809***		-0.797***	-0.716***		-1.210***	-1.045***		0.413**
Panel K: Accounting Accruals										
Non-positive Accruals	3.471	2.940	8,546	3.304	2.791	4,611	3.666	3.139	3,935	-0.362***
Positive Accruals	4.039	3.186	2,211	3.579	2.779	1,068	4.469	3.663	1,143	-0.890***
Difference	-0.569***	-0.246***		-0.275***	0.012		-0.803***	-0.524***		0.528***

Table 1.4: Descriptive statistics of the determinants of yield spreads

This table reports summary statistics of yield spread, hedging dummy, and other explanatory variables for the sample of 10,757 firm-year observations from 1994 through 2009 with winsorization at the 5th and 95th percentiles. All variable definitions are reported in Appendix.

	N	Mean	Median	S.D.	Min	Max
Yield Spread (%)	10,757	3.59	2.98	3.37	-5.24	13.48
Hedging (Dum)	10,757	0.53	1.00	0.50	0.00	1.00
Leverage (%)	10,757	25.85	22.56	16.06	4.32	61.20
Interest Coverage	10,757	9.18	5.82	9.83	-1.54	38.43
Altman's Z-score	10,757	2.08	1.99	1.25	-0.21	4.60
Market-to-book Ratio	10,757	1.65	1.42	0.70	0.90	3.54
Profitability (%)	10,757	12.51	12.47	7.10	-3.21	26.11
Earnings Volatility (%)	10,757	3.43	2.28	3.21	0.41	12.53
Asset Return Volatility (%)	10,757	8.71	7.57	4.34	3.44	19.76
Log (Total Assets)	10,757	7.81	7.74	1.35	5.55	10.33
Private Debt Ratio (%)	10,757	13.04	8.97	12.81	0.00	52.69
Sale Growth (%)	10,757	4.21	1.73	26.65	-60.45	141.60
Risk-shifting Index	10,757	0.61	0.64	0.24	0.00	1.00
Normalized Forecasts Error (%)	8,941	11.74	3.45	20.42	0.08	81.48
Forecasts Dispersion (%)	8,552	5.03	3.00	5.55	0.67	21.67
Positive Accruals (Dum)	10,757	0.21	0.00	0.40	0.00	1.00
Credit Rating	10,757	9.34	9.50	5.91	0.00	22.00
Bond Age	10,757	3.22	2.80	2.30	0.14	12.02
Coupon (%)	10,757	6.90	7.00	2.18	2.75	10.75
Modified Duration	10,757	5.91	5.32	2.99	1.04	13.68
Convexity	10,757	65.89	39.58	67.39	1.63	272.90
Convetible	10,757	0.31	0.00	0.46	0.00	1.00
Callable	10,757	0.86	1.00	0.34	0.00	1.00
Market Credit Premium (%)	10,757	1.12	0.95	0.70	0.56	3.38
Interest Rate Level (%)	10,757	4.59	4.47	1.09	2.42	7.81
Slope (%)	10,757	0.99	0.60	0.89	-0.23	2.37
Equity Market Premium (%)	10,757	5.27	10.58	20.61	-38.39	31.04
SMB (%)	10,757	3.93	1.04	12.85	-23.29	28.41
HML (%)	10,757	3.31	3.71	17.24	-39.40	27.24

Table 1.5: Baseline models of cost of debt on hedging and other determinants

This table reports the baseline multivariate Pooled OLS regressions for the full sample (Panel A), and subsamples by credit rating (Panel B). The dependent variable is yield spread. The first column shows the expected relation (positive or negative) between yield spread and its determinants, including firm-specific determinants (hedging, leverage, interest coverage, Altman's Z-score, market-to-book ratio, profitability, earnings volatility, firm size, private debt ratio, and credit rating), bond-specific factors (bond age, coupon, modified duration, convexity, convertible and callable), and systematic risk factors including market credit premium, interest rate level, slope, and equity market premium, SMB and HML. All variable definitions are reported in Appendix. In Panels A and B, we control for industry effects by using industry dummies based on the Fama-French 48-industry classification and control for time effects by using year dummies. The coefficients (β) and Newey-West standard errors (SE) are reported on the first and second columns for each model. ∗, ∗∗ and ∗∗∗ denote significance at the 10%, 5% and 1% level, respectively.

		Panel A: Full Sample Pooled OLS Regressions				**Panel B: Pooled OLS Regressions by Credit Rating**			
						Investment Grade		**Speculative Grade**	
Explanatory	**Pred.**	**model 1**		**model 2**		**model 2**		**model 2**	
Variables	**Sign**	**β**	**SE**	**β**	**SE**	**β**	**SE**	**β**	**SE**
Hedging	-	-0.408***	0.053	-0.241***	0.045	-0.129***	0.042	-0.266***	0.060
Leverage	+	0.050***	0.003	0.051***	0.003	0.036***	0.005	0.045***	0.003
Interest Coverage	-	-0.012***	0.004	-0.013***	0.003	-0.012***	0.003	-0.013***	0.004
Altman's Z-score	-	-0.087**	0.043	-0.070*	0.037	0.059	0.044	-0.105**	0.042
Market-to-book Ratio	+/-	-0.309***	0.059	-0.015	0.051	-0.112**	0.057	-0.217***	0.067
Profitability	-	-0.043***	0.006	-0.050***	0.005	-0.012*	0.006	-0.056***	0.006
Earnings Volatility	+	0.075***	0.011	0.042***	0.009	0.021	0.014	0.051***	0.010
Firm Size	-	-0.070**	0.030	-0.198***	0.026	-0.153***	0.026	-0.208***	0.035
Private Debt Ratio	+	0.021***	0.003	0.017***	0.003	-0.008*	0.004	0.018***	0.003
Credit Rating	-	-0.064***	0.008	-0.047***	0.007	-0.061***	0.013	-0.053***	0.010
Bond Age	+	-0.002	0.014	-0.013	0.012	-0.029**	0.013	0.011	0.018
Coupon	+	0.707***	0.023	0.793***	0.021	0.642***	0.034	0.721***	0.027
Modified Duration	-	-0.426***	0.042	-0.363***	0.036	0.166***	0.037	-0.519***	0.047
Convexity	+	0.010***	0.002	0.009***	0.001	-0.005***	0.001	0.013***	0.002
Convertible	-	-0.452***	0.097	-0.356***	0.084	-0.654***	0.103	-0.416***	0.103
Callable	+	0.623***	0.091	0.347***	0.081	0.063	0.057	0.613***	0.145
Market Credit Premium	+			0.412***	0.071	0.217***	0.066	0.313***	0.100
Interest Rate Level	-			-0.126**	0.063	-0.267***	0.064	-0.112	0.087
Slope	+/-			1.337***	0.051	0.947***	0.047	1.448***	0.068
Equity Market Premium	-			-0.011***	0.003	-0.007***	0.002	-0.020***	0.004
SMB	+			0.029***	0.004	0.016***	0.004	0.044***	0.006
HML	+			-0.003**	0.001	-0.005***	0.001	-0.003	0.002
Intercept		2.895***	0.661	0.783	0.637	0.544	0.543	2.650***	0.649
Industry Dummies		Yes		Yes		Yes		Yes	
Year Dummies		Yes		Yes		Yes		Yes	
Number of observations		10,757		10,757		3,863		6,894	
Adjusted R-squared		0.547		0.700		0.675		0.712	

Table 1.6: The impact of hedging on cost of debt across industries and relevant risk exposures

This table reports the Pooled OLS regressions of the baseline model for subsamples in seven main industry groups (Panel A), and subsamples by ex ante risk exposures (Panel B). The dependent variable is yield spread. All variable definitions are reported in Appendix. We control for industry effects by using industry dummies based on the Fama-French 48-industry classification and control for time effects by using year dummies. The coefficients (β) and Newey-West standard errors (SE) are reported on the first and second columns for each model. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

		Panel A: Pooled OLS Regressions by Industry													
Explanatory Variables	Pred. Sign	Agriculture, Mining & Construction		Manufacturing		Transportation		Communications & Utilities		Wholesales & Retails		Services & Public Administration		Oil & Gas	
		β	SE	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Hedging	-	-0.266**	0.129	-0.193***	0.065	-0.432**	0.194	-0.406***	0.115	-0.479***	0.129	-0.181	0.130	-0.387***	0.114
Leverage	+	0.039***	0.009	0.060***	0.005	0.042***	0.014	0.054***	0.009	0.044***	0.007	0.034***	0.008	0.030***	0.008
Interest Coverage	-	-0.007	0.007	-0.017***	0.004	0.011	0.017	-0.021	0.013	-0.009	0.008	-0.008	0.008	-0.002	0.006
Altman's Z-score	-	-0.063	0.114	-0.048	0.060	-0.186	0.157	0.008	0.159	-0.088	0.088	-0.195**	0.091	-0.089	0.063
Market-to-book Ratio	+/-	-0.298*	0.154	-0.073	0.073	0.881***	0.297	0.350**	0.166	-0.022	0.139	0.068	0.137	-0.211	0.136
Profitability	-	-0.020*	0.011	-0.045***	0.008	-0.071**	0.030	-0.079***	0.013	-0.089***	0.016	-0.057***	0.014	-0.019*	0.010
Earnings Volatility	+	-0.003	0.019	0.037***	0.013	0.060	0.053	0.052*	0.031	0.129***	0.035	0.034	0.025	-0.013	0.019
Firm Size	-	-0.262**	0.112	-0.219***	0.039	-0.236*	0.123	-0.114*	0.058	-0.260***	0.068	-0.253***	0.077	-0.212**	0.105
Private Debt Ratio	+	0.011	0.008	0.018***	0.005	0.038***	0.013	0.001	0.006	0.020***	0.007	0.025***	0.007	0.009	0.008
Credit Rating	-	-0.076**	0.033	-0.036***	0.011	-0.094**	0.042	-0.053***	0.017	-0.059***	0.021	-0.022	0.018	-0.067*	0.035
Bond Age	+	0.029	0.041	-0.002	0.018	0.072	0.063	-0.084**	0.033	-0.005	0.027	-0.001	0.037	0.002	0.035
Coupon	+	0.801***	0.076	0.781***	0.028	0.849***	0.102	0.839***	0.060	0.764***	0.061	0.684***	0.049	0.825***	0.072
Modified Duration	-	-0.374***	0.128	-0.315***	0.052	-0.678**	0.265	-0.281***	0.092	-0.358***	0.104	-0.560***	0.093	-0.235**	0.117
Convexity	+	0.011**	0.005	0.007***	0.002	0.018	0.011	0.009**	0.004	0.010**	0.004	0.014***	0.004	0.006	0.004
Convertible	-	-0.589**	0.231	-0.410***	0.127	0.250	0.292	-0.005	0.275	-0.762***	0.213	-0.385**	0.193	-0.477**	0.228
Callable	+	0.649**	0.265	0.321***	0.107	0.482	0.363	0.049	0.237	0.261	0.236	0.537*	0.279	0.389	0.257
Market Credit Premium	+	0.487**	0.201	0.368***	0.104	0.424	0.311	0.271	0.193	0.603***	0.197	0.473**	0.201	0.483***	0.182
Interest Rate Level	-	-0.196	0.216	-0.165*	0.089	-0.397	0.300	0.000	0.171	0.069	0.184	-0.153	0.174	-0.250	0.205
Slope	+/-	1.320***	0.165	1.354***	0.070	1.444***	0.279	1.339***	0.149	1.354***	0.138	1.261***	0.133	1.348***	0.163
Equity Market Premium	-	-0.005	0.008	-0.009**	0.004	0.003	0.012	-0.024***	0.007	-0.010	0.007	-0.013	0.008	-0.004	0.007
SMB	+	0.035***	0.013	0.028***	0.006	0.014	0.021	0.035***	0.012	0.010	0.012	0.045***	0.012	0.038***	0.012
HML	+	-0.012***	0.004	-0.004*	0.002	-0.005	0.007	0.006*	0.004	-0.003	0.004	-0.004	0.004	-0.013***	0.004
Intercept		2.232	1.619	1.510**	0.714	2.445	2.386	-0.024	1.167	1.314	1.332	2.541**	1.208	1.026	1.518
Industry Dummies		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year Dummies		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Number of observations		951		5,345		399		1,449		1,278		1,335		864	
Adjusted R-squared		0.759		0.677		0.803		0.719		0.708		0.721		0.776	

Table 1.6 (continued)

	Panel B: Pooled OLS Regressions by Ex Ante Risk Exposure						
	Pred. Sign	Currency Risk		Interest Rate Risk		Commodity Risk	
		β	SE	β	SE	β	SE
Foreign Currency Hedging	-	-0.104**	0.052				
Interest Rate Hedging	-			-0.245***	0.045		
Commodity Hedging	-					-0.204**	0.096
Leverage	+	0.053***	0.003	0.053***	0.003	0.043***	0.006
Interest Coverage	-	-0.014***	0.003	-0.010***	0.003	0.005	0.006
Altman's Z-score	-	-0.086**	0.040	-0.088**	0.040	-0.185***	0.068
Market-to-book Ratio	+/-	-0.008	0.056	0.046	0.054	0.137	0.110
Profitability	-	-0.046***	0.006	-0.051***	0.005	-0.046***	0.008
Earnings Volatility	+	0.039***	0.010	0.031***	0.010	-0.015	0.013
Firm Size	-	-0.237***	0.028	-0.199***	0.026	-0.157***	0.054
Private Debt Ratio	+	0.015***	0.003	0.016***	0.003	0.012**	0.006
Credit Rating	-	-0.038***	0.008	-0.055***	0.007	-0.086***	0.017
Bond Age	+	-0.013	0.014	-0.012	0.013	0.014	0.023
Coupon	+	0.811***	0.022	0.796***	0.021	0.819***	0.045
Modified Duration	-	-0.336***	0.039	-0.353***	0.038	-0.408***	0.082
Convexity	+	0.008***	0.002	0.009***	0.002	0.011***	0.003
Convertible	-	-0.323***	0.090	-0.371***	0.087	-0.529***	0.161
Callable	+	0.300***	0.093	0.347***	0.082	0.475***	0.160
Market Credit Premium	+	0.539***	0.080	0.402***	0.072	0.325**	0.127
Interest Rate Level	-	-0.122*	0.070	-0.164**	0.064	-0.332***	0.119
Slope	+/-	1.407***	0.053	1.295***	0.052	1.335***	0.106
Equity Market Premium	-	-0.004	0.003	-0.009***	0.003	-0.005	0.005
SMB	+	0.014***	0.005	0.029***	0.004	0.035***	0.008
HML	+	0.002	0.002	-0.004**	0.001	-0.008***	0.003
Intercept		0.352	0.505	1.418***	0.510	2.090*	1.087
Industry Dummies		Yes		Yes		Yes	
Year Dummies		Yes		Yes		Yes	
Number of observations		8,856		9,996		2,369	
Adjusted R2		0.712		0.701		0.738	

Table 1.7: Hedging initiations and suspensions

This table presents the cross-sectional difference of hedging policy on cost of debt. 136 hedging initiation firms and 352 hedging suspension firms are first identified from 1993 to 2008, and then propensity score matching procedure is applied to find the matching pair, accordingly, for each hedging initiation firm and each hedging suspension firm. We report the results of OLS regressions of the change in yield spread on the change in hedging policy (initiation/suspension). The initiation (suspension) dummy variable takes the value of one if a firm initiates (suspends) hedging strategy in year *t*, and zero otherwise. We compute change in yield spread and the change of each of other explanatory variables, which are denoted by Δ and measure the difference in level between year *t* and *t-1*. We control for both time effects and industry effects (first-digit SIC codes). The coefficients (β) and robust standard errors (SE) are reported. ∗, ∗∗ and ∗∗∗ denote significance at the 10%, 5% and 1% level, respectively.

Explanatory Variables	Pred. Sign	Hedging Initiation		Hedging Suspension	
		β	SE	β	SE
Initiation Dummy	-	-0.392*	0.232		
Suspension Dummy	+			0.580**	0.251
ΔLeverage	+	0.026	0.018	0.040***	0.009
ΔInterest Coverage	-	-0.014	0.024	-0.017	0.014
ΔAltman's Z-score	-	0.398*	0.235	-0.041	0.112
ΔMarket to Book Ratio	+/-	-0.762**	0.317	-0.248	0.180
ΔProfitability	-	-0.008	0.027	-0.057***	0.020
ΔEarnings Volatility	+	0.009	0.050	0.061*	0.034
ΔFirm Size	-	-0.393*	0.210	-0.326***	0.107
ΔPrivate Debt Ratio	+	-0.002	0.015	0.020**	0.009
ΔCredit Rating	-	-0.074	0.063	-0.065***	0.022
ΔBond Age	+	-0.164*	0.095	-0.059	0.052
ΔCoupon	+	0.715***	0.153	0.605***	0.080
ΔModified Duration	-	-0.706**	0.348	-0.403***	0.148
ΔConvexity	+	0.027*	0.014	0.006	0.006
ΔConvertible	-	-1.092	0.687	-0.879**	0.394
ΔCallable	+	0.407	0.475	1.378***	0.252
ΔMarket Credit Premium	+	-1.322***	0.435	0.249	0.363
ΔInterest Rate Level	-	-0.345	0.297	0.019	0.142
ΔSlope	+/-	1.479***	0.264	1.818***	0.197
ΔEquity Market Premium	-	-0.044***	0.012	-0.002	0.010
ΔSMB	+	0.031**	0.015	0.021	0.013
ΔHML	+	0.004	0.008	-0.028***	0.008
Intercept		0.511	0.408	-0.381	0.815
Industry and Year Dummies		Yes		Yes	
Number of observations		272		704	
Adjusted R-squared		0.561		0.681	

Table 1.8: Extended multivariate regressions of cost of debt on hedging and other determinants

This table reports the full-sample results from firm fixed effects, lagged variables, Heckman's treatment model, propensity score matching (PSM), instrument variable model (IV), simultaneous equation model (SEM), and dynamic panel GMM regressions. The dependent variable is yield spread.

Explanatory Variables	Pred. Sign	Firm Fixed Effect		Lagged Variables		Treatment Model		PSM		IV Estimation		SEM		Dynamic GMM	
		β	SE	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Hedging	-	-0.300***	0.059	-0.146**	0.060	-0.583**	0.269	-0.186***	0.033	-0.852**	0.395	-0.256***	0.073	-0.730**	0.297
Leverage	+	0.040***	0.004	0.052***	0.004	0.052***	0.003	0.047***	0.002	0.053***	0.003	0.053***	0.001	0.050*	0.029
Interest Coverage	-	-0.011***	0.004	-0.015***	0.004	-0.015***	0.003	-0.007***	0.003	-0.016***	0.003	-0.016***	0.002	-0.046	0.040
Altman's Z-score	-	0.010	0.088	0.031	0.050	-0.073**	0.031	-0.086***	0.030	-0.071**	0.031	-0.072***	0.016	-0.116	0.382
Market to Book Ratio	+/-	-0.222**	0.091	0.049	0.066	0.004	0.047	-0.027	0.041	0.021	0.051	0.017	0.026	1.013***	0.380
Profitability	-	-0.038***	0.008	-0.050***	0.007	-0.049***	0.004	-0.050***	0.004	-0.049***	0.004	-0.049***	0.002	0.017	0.063
Earnings Volatility	+	-0.006	0.013	0.048***	0.012	0.039***	0.008	0.049***	0.008	0.037***	0.009	0.038***	0.004	-0.074	0.055
Firm Size	-	-0.066	0.088	-0.197***	0.033	-0.178***	0.026	-0.167***	0.020	-0.161***	0.032	-0.166***	0.018	-0.601*	0.308
Private Debt Ratio	+	0.025***	0.004	0.001	0.004	0.017***	0.002	0.015***	0.002	0.017***	0.002	0.017***	0.001	0.063*	0.035
Credit Rating	-	-0.070***	0.013	-0.045***	0.009	-0.046***	0.006	-0.051***	0.006	-0.046***	0.006	-0.046***	0.003	0.157	0.131
Bond Age	+	-0.036*	0.020	-0.065***	0.015	-0.014	0.010	-0.004	0.010	-0.017*	0.010	-0.017***	0.006	0.043	0.067
Coupon	+	0.656***	0.043	0.807***	0.026	0.793***	0.017	0.791***	0.016	0.796***	0.017	0.795***	0.009	-0.519	0.416
Modified Duration	-	-0.393***	0.056	-0.062	0.045	-0.363***	0.030	-0.316***	0.029	-0.357***	0.030	-0.357***	0.016	0.188	0.410
Convexity	+	0.010***	0.002	-0.004**	0.002	0.009***	0.001	0.007***	0.001	0.009***	0.001	0.009***	0.001	-0.019	0.018
Convertible	-	-0.576***	0.131	0.087	0.110	-0.353***	0.069	-0.402***	0.066	-0.350***	0.070	-0.351***	0.038	-3.719*	1.952
Callable	+	0.164	0.121	0.211**	0.097	0.347***	0.066	0.531***	0.064	0.371***	0.068	0.367***	0.036	0.719**	0.337
Market Credit Premium	+	0.331***	0.080	-0.011	0.083	0.362***	0.080	0.377***	0.065	0.329***	0.091	0.340***	0.053	0.208	0.428
Interest Rate Level	-	0.056	0.096	-0.468***	0.074	-0.151**	0.063	0.022	0.059	-0.130**	0.061	-0.129***	0.038	-0.460	0.760
Slope	+/-	1.353***	0.058	-0.141**	0.064	1.321***	0.053	1.272***	0.048	1.267***	0.070	1.280***	0.042	0.691	0.449
Equity Market Premium	-	-0.019***	0.003	-0.045***	0.002	-0.013***	0.003	-0.019***	0.002	-0.017***	0.005	-0.016***	0.003	-0.022***	0.005
SMB	+	0.035***	0.005	0.092***	0.006	0.030***	0.005	0.038***	0.004	0.035***	0.006	0.034***	0.004	0.033*	0.018
HML	+	-0.000	0.001	-0.079***	0.005	-0.004**	0.002	-0.002	0.002	-0.003	0.002	-0.003**	0.001	-0.011	0.007
Lagged Yield Spread	+													0.472***	0.125
Intercept		0.829	1.014	3.151***	0.835	1.031**	0.477	-0.936**	0.415	1.019**	0.464	0.592	0.360	8.364*	4.831
Industry Dummies		No		Yes		Yes		Yes		Yes		Yes		Yes	
Year Dummies		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Kleibergen-Paap rk LM statistic (p-value)										0.000					
Kleibergen-Paap rk Wald F statistic										70.340					
Hansen test of over-identification (p-value)														0.136	
Diff-in-Hansen tests of exogeneity (p-value)														0.154	
Number of observations		10,757		8,925		10,757		11,358		10,757		10,757		8,556	
Adjusted R-squared		0.605		0.571		n/a		0.721		0.694		n/a		n/a	

Table 1.9: Sources of hedging benefit: financial risk hypothesis

This table reports the results from the Pooled OLS and treatment model regressions with interaction terms. Panels A, B and C present the results in which credit rating, speculative dummy, and leverage are the proxies of financial risk. The dependent variable is yield spread. All variable definitions are reported in Appendix. We control for industry effects by using industry dummies based on the Fama-French 48-industry classification and control for time effects by using year dummies. The coefficients (β) and robust standard errors (SE) are reported. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Explanatory Variables	Pred. Sign	Panel A: Credit Rating				Panel B: Speculative Dummy				Panel C: Leverage			
		Pooled OLS		Treatment Model		Pooled OLS		Treatment Model		Pooled OLS		Treatment Model	
		β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Hedging	-	-0.369***	0.097	-0.727**	0.307	-0.131**	0.056	-0.508*	0.298	-0.242***	0.045	-0.586**	0.293
Hedging × Credit Rating	+	0.014*	0.008	0.014**	0.006								
Credit Rating	-	-0.054***	0.008	-0.054***	0.006	-0.038***	0.009	-0.037***	0.007	-0.046***	0.007	-0.046***	0.005
Hedging × Speculative_Dummy	-					-0.173**	0.076	-0.176**	0.076				
Speculative_Dummy	+					0.243***	0.086	0.247***	0.081				
Hedging × Leverage	-									-0.011**	0.004	-0.011***	0.003
Leverage	+	0.051***	0.003	0.052***	0.002	0.051***	0.003	0.052***	0.002	0.057***	0.004	0.058***	0.003
Interest Coverage	-	-0.013***	0.003	-0.015***	0.003	-0.013***	0.003	-0.015***	0.003	-0.013***	0.003	-0.015***	0.003
Altman's Z-score	-	-0.070*	0.037	-0.072***	0.027	-0.072*	0.037	-0.074***	0.027	-0.071*	0.037	-0.073***	0.027
Market to Book Ratio	+/-	-0.018	0.051	0.000	0.040	-0.011	0.051	0.009	0.040	-0.014	0.051	0.004	0.040
Profitability	-	-0.049***	0.005	-0.048***	0.004	-0.049***	0.005	-0.049***	0.004	-0.050***	0.005	-0.049***	0.004
Earnings Volatility	+	0.042***	0.009	0.039***	0.007	0.042***	0.009	0.039***	0.007	0.042***	0.009	0.040***	0.007
Firm Size	-	-0.197***	0.026	-0.177***	0.026	-0.195***	0.026	-0.173***	0.026	-0.199***	0.026	-0.179***	0.025
Private Debt Ratio	+	0.017***	0.003	0.017***	0.002	0.017***	0.003	0.017***	0.002	0.017***	0.003	0.017***	0.002
Bond Age	+	-0.014	0.012	-0.014	0.009	-0.013	0.012	-0.013	0.009	-0.014	0.012	-0.015	0.009
Coupon	+	0.794***	0.021	0.794***	0.014	0.786***	0.021	0.786***	0.015	0.794***	0.021	0.793***	0.014
Modified Duration	-	-0.364***	0.036	-0.364***	0.025	-0.368***	0.036	-0.369***	0.025	-0.364***	0.036	-0.365***	0.025
Convexity	+	0.009***	0.001	0.009***	0.001	0.009***	0.001	0.009***	0.001	0.009***	0.001	0.009***	0.001
Convertible	-	-0.352***	0.084	-0.348***	0.062	-0.370***	0.085	-0.367***	0.063	-0.353***	0.084	-0.349***	0.062
Callable	+	0.347***	0.081	0.348***	0.056	0.328***	0.081	0.329***	0.057	0.344***	0.081	0.344***	0.056
Market Credit Premium	+	0.409***	0.071	0.360***	0.082	0.411***	0.071	0.359***	0.082	0.408***	0.071	0.360***	0.081
Interest Rate Level	-	-0.127**	0.063	-0.126**	0.061	-0.120*	0.063	-0.119*	0.062	-0.127**	0.063	-0.126**	0.061
Slope	+/-	1.335***	0.051	1.295***	0.066	1.339***	0.051	1.297***	0.066	1.334***	0.051	1.296***	0.065
Equity Market Premium	-	-0.011***	0.003	-0.015***	0.004	-0.011***	0.003	-0.015***	0.004	-0.011***	0.003	-0.015***	0.004
SMB	+	0.029***	0.004	0.033***	0.006	0.029***	0.004	0.033***	0.006	0.029***	0.004	0.033***	0.006
HML	+	-0.003**	0.001	-0.003	0.002	-0.003**	0.001	-0.003	0.002	-0.003**	0.001	-0.003	0.002
Intercept		0.852*	0.510	1.017*	0.602	0.592	0.648	0.763	0.604	0.789	0.501	0.948	0.600
Industry Dummies		Yes		Yes		Yes		Yes		Yes		Yes	
Year Dummies		Yes		Yes		Yes		Yes		Yes		Yes	
Number of observations		10,757		10,757		10,757		10,757		10,757		10,757	
Adjusted R-squared		0.700		n/a		0.701		n/a		0.701		n/a	

Table 1.10: Sources of hedging benefits: agency costs hypothesis

This table reports the results from the Pooled OLS and treatment model regressions with interaction terms. We use the product of hedging and the proxy of agency costs to examine the difference in hedging effect on cost of debt between the firms with severe agency problems and those without. Proxies for agency costs include sales growth, convertible bond dummy, and the risk-shifting index. The dependent variable is yield spread.

Explanatory Variables	Pred. Sign	Panel A: Sales Growth				Panel B: Convertible Dummy				Panel C: Risk-shifting Index			
		Pooled OLS		Treatment Model		Pooled OLS		Treatment Model		Pooled OLS		Treatment Model	
		β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Hedging	-	-0.218***	0.044	-0.536*	0.289	-0.282***	0.048	-0.590**	0.284	-0.208**	0.097	-0.565*	0.306
Hedging × Sales Growth	-	-0.002	0.002	-0.002	0.001								
Sales Growth	+	0.006***	0.001	0.006***	0.001								
Hedging × Convertible	+					0.130	0.102	0.127	0.079				
Convertible	-	-0.356***	0.084	-0.352***	0.062	-0.428***	0.101	-0.423***	0.076	-0.366***	0.084	-0.363***	0.062
Hedging × Risk-shifting Index	-									-0.056	0.152	-0.050	0.149
Risk-shifting Index	+									0.212*	0.123	0.213**	0.108
Leverage	+	0.051***	0.003	0.052***	0.002	0.051***	0.003	0.052***	0.002	0.051***	0.003	0.052***	0.002
Interest Coverage	-	-0.011***	0.003	-0.013***	0.003	-0.013***	0.003	-0.015***	0.003	-0.013***	0.003	-0.015***	0.003
Altman's Z-score	-	-0.066*	0.037	-0.067**	0.026	-0.071*	0.037	-0.072***	0.027	-0.068*	0.037	-0.069***	0.027
Market to Book Ratio	+/-	-0.035	0.051	-0.019	0.040	-0.014	0.051	0.002	0.040	-0.016	0.051	0.002	0.040
Profitability	-	-0.051***	0.005	-0.050***	0.004	-0.050***	0.005	-0.049***	0.004	-0.050***	0.005	-0.049***	0.004
Earnings Volatility	+	0.039***	0.009	0.037***	0.007	0.042***	0.009	0.040***	0.007	0.042***	0.009	0.039***	0.007
Firm Size	-	-0.046***	0.007	-0.045***	0.005	-0.047***	0.007	-0.046***	0.005	-0.046***	0.007	-0.045***	0.005
Private Debt Ratio	+	-0.194***	0.026	-0.176***	0.025	-0.199***	0.026	-0.181***	0.025	-0.200***	0.026	-0.180***	0.025
Credit Rating	-	0.017***	0.003	0.017***	0.002	0.017***	0.003	0.017***	0.002	0.017***	0.003	0.017***	0.002
Bond Age	+	-0.015	0.012	-0.015*	0.009	-0.012	0.012	-0.012	0.009	-0.017	0.013	-0.018*	0.009
Coupon	+	0.792***	0.021	0.791***	0.014	0.791***	0.021	0.791***	0.014	0.794***	0.021	0.793***	0.014
Modified Duration	-	-0.355***	0.036	-0.355***	0.025	-0.361***	0.036	-0.361***	0.025	-0.365***	0.036	-0.365***	0.025
Convexity	+	0.009***	0.001	0.009***	0.001	0.009***	0.001	0.009***	0.001	0.009***	0.001	0.009***	0.001
Callable	+	0.348***	0.081	0.348***	0.056	0.347***	0.081	0.348***	0.056	0.339***	0.081	0.340***	0.056
Market Credit Premium	+	0.430***	0.071	0.386***	0.081	0.414***	0.071	0.371***	0.081	0.417***	0.071	0.368***	0.081
Interest Rate Level	-	-0.096	0.063	-0.095	0.061	-0.123*	0.063	-0.123**	0.061	-0.119*	0.063	-0.118*	0.062
Slope	+/-	1.345***	0.050	1.310***	0.065	1.340***	0.051	1.305***	0.065	1.343***	0.051	1.303***	0.065
Equity Market Premium	-	-0.012***	0.003	-0.015***	0.004	-0.011***	0.003	-0.014***	0.004	-0.011***	0.003	-0.014***	0.004
SMB	+	0.030***	0.004	0.033***	0.006	0.029***	0.004	0.032***	0.006	0.029***	0.004	0.032***	0.006
HML	+	-0.003**	0.001	-0.003	0.002	-0.003**	0.001	-0.003	0.002	-0.003**	0.001	-0.003	0.002
Intercept		0.544	0.499	0.691	0.599	0.789	0.500	0.932	0.599	0.663	0.505	0.826	0.604
Industry Dummies		Yes		Yes		Yes		Yes		Yes		Yes	
Year Dummies		Yes		Yes		Yes		Yes		Yes		Yes	
Number of observations		10,757		10,757		10,757		10,757		10,757		10,757	
Adjusted R-squared		0.702		n/a		0.700		n/a		0.700		n/a	

Table 1.11: Sources of hedging benefits: information asymmetry hypothesis

This table reports results from the Pooled OLS and treatment model regressions with interaction terms. Panels A, B, and C present the results in which we use the three proxies for information asymmetry (normalized forecast error, forecast dispersion and positive accounting accruals), respectively. The dependent variable is yield spread.

Explanatory Variables	Pred. Sign	Panel A: Normalized Forecasts Error				Panel B: Forecasts Dispersion				Panel C: Accounting Accruals			
		Pooled OLS		Treatment Model		Pooled OLS		Treatment Model		Pooled OLS		Treatment Model	
		β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Hedging	-	-0.153***	0.050	-0.368**	0.151	-0.155***	0.060	-0.482***	0.144	-0.172***	0.047	-0.501*	0.293
Hedging × Normalized Forecasts Error	-	-0.007***	0.002	-0.006***	0.002								
Normalized Forecasts Error	+	0.013***	0.002	0.013***	0.001								
Hedging × Forecasts Dispersion	-					-0.016**	0.008	-0.016**	0.007				
Forecasts Dispersion	+					0.037***	0.007	0.035***	0.005				
Hedging × Positive Accruals	-									-0.319***	0.098	-0.321***	0.088
Positive Accruals	+									0.433***	0.075	0.433***	0.063
Leverage	+	0.049***	0.003	0.049***	0.002	0.049***	0.003	0.050***	0.002	0.051***	0.003	0.052***	0.002
Interest Coverage	-	-0.016***	0.003	-0.017***	0.003	-0.017***	0.003	-0.019***	0.003	-0.014***	0.003	-0.016***	0.003
Altman's Z-score	-	-0.001	0.036	-0.012	0.024	-0.001	0.037	-0.005	0.024	-0.064*	0.037	-0.066**	0.026
Market to Book Ratio	+/-	-0.056	0.054	-0.041	0.036	-0.064	0.055	-0.045	0.036	-0.022	0.051	-0.005	0.040
Profitability	-	-0.039***	0.005	-0.038***	0.004	-0.039***	0.005	-0.038***	0.004	-0.047***	0.005	-0.046***	0.004
Earnings Volatility	+	0.027***	0.010	0.021***	0.007	0.024**	0.010	0.017**	0.007	0.041***	0.009	0.039***	0.007
Firm Size	-	-0.206***	0.027	-0.196***	0.021	-0.202***	0.027	-0.187***	0.021	-0.190***	0.026	-0.171***	0.025
Private Debt Ratio	+	0.017***	0.003	0.015***	0.002	0.016***	0.003	0.013***	0.002	0.016***	0.003	0.016***	0.002
Credit Rating	-	-0.036***	0.007	-0.036***	0.006	-0.034***	0.008	-0.037***	0.006	-0.047***	0.007	-0.047***	0.005
Bond Age	+	-0.029**	0.013	-0.031***	0.009	-0.040***	0.013	-0.042***	0.010	-0.015	0.012	-0.015*	0.009
Coupon	+	0.771***	0.022	0.772***	0.015	0.773***	0.022	0.774***	0.015	0.794***	0.021	0.793***	0.014
Modified Duration	-	-0.221***	0.037	-0.220***	0.026	-0.214***	0.037	-0.214***	0.026	-0.360***	0.036	-0.360***	0.025
Convexity	+	0.004**	0.002	0.004***	0.001	0.004**	0.002	0.004***	0.001	0.009***	0.001	0.009***	0.001
Convertible	-	-0.424***	0.084	-0.384***	0.063	-0.382***	0.084	-0.331***	0.063	-0.351***	0.084	-0.348***	0.062
Callable	+	0.259***	0.084	0.275***	0.056	0.216**	0.085	0.243***	0.056	0.347***	0.081	0.347***	0.056
Market Credit Premium	+	0.467***	0.075	0.442***	0.078	0.425***	0.075	0.386***	0.077	0.407***	0.071	0.362***	0.081
Interest Rate Level	-	-0.178***	0.066	-0.178***	0.064	-0.160**	0.067	-0.158**	0.064	-0.116*	0.063	-0.116*	0.061
Slope	+/-	1.304***	0.051	1.283***	0.062	1.297***	0.052	1.266***	0.062	1.343***	0.050	1.306***	0.065
Equity Market Premium	-	-0.007**	0.003	-0.009***	0.003	-0.009***	0.003	-0.013***	0.003	-0.011***	0.003	-0.015***	0.004
SMB	+	0.026***	0.005	0.028***	0.005	0.027***	0.005	0.030***	0.005	0.029***	0.004	0.032***	0.006
HML	+	-0.003**	0.001	-0.003*	0.002	-0.004***	0.001	-0.004**	0.002	-0.003**	0.001	-0.003	0.002
Intercept		1.249**	0.528	0.682	0.437	0.103	0.540	0.700	0.438	0.529	0.501	0.681	0.600
Industry Dummies		Yes		Yes		Yes		Yes		Yes		Yes	
Year Dummies		Yes		Yes		Yes		Yes		Yes		Yes	
Number of observations		8,941		8,941		8,552		8,552		10,757		10,757	
Adjusted R-squared		0.698		n/a		0.690		n/a		0.702		n/a	

Table 1.12: Economic value of hedging

This table reports the results from the Pooled OLS and treatment model regressions of capital expenditure, Tobin's Q and excess stock return on yield spread, hedging, an interaction item of yield spread and hedging, and other control variables.

Explanatory Variables	Panel A: Hedging and Capital Expenditure				Panel B: Hedging and Tobin's Q			
	Pooled OLS		Treatment Model		Pooled OLS		Treatment Model	
	β	SE	β	SE	β	SE	β	SE
Yield Spread	-0.094***	0.021	-0.086***	0.019	-0.018***	0.001	-0.017***	0.001
Yield Spread × Hedging	0.051**	0.026	0.050**	0.025	0.003	0.002	0.003*	0.001
Hedging	-0.147	0.174	0.559	0.446	0.028***	0.008	0.271***	0.024
Firm Size	-0.150***	0.044	-0.211***	0.048	-0.018***	0.002	-0.031***	0.003
Leverage	-0.022***	0.005	-0.022***	0.004	-0.007***	0.000	-0.007***	0.000
Credit Rating	0.016	0.011	0.018*	0.011	0.003***	0.001	0.002**	0.001
Market to Book Ratio	0.770***	0.097	0.711***	0.086				
Earnings Volatility	0.080***	0.019	0.095***	0.016				
Cash Flow/Lag(Total Assets)	0.273***	0.010	0.275***	0.007				
Cash Holding/Lag(Total Assets)	0.009	0.006	0.014***	0.005				
Stock Return	0.003**	0.001	0.002**	0.001				
Regulation Dummy	3.259***	0.371	3.200**	1.473	-0.004	0.027	-0.010	0.086
Profitability					0.010***	0.001	0.010***	0.001
Altman's Z-score					0.071***	0.004	0.075***	0.004
CAPX/Lag(Total Assets)					0.008***	0.001	0.007***	0.001
R&D/Lag(Total Assets)					0.028***	0.001	0.028***	0.001
Advertising /Lag(Sales)					0.010***	0.002	0.010***	0.001
Dividend Dummy					-0.017***	0.006	-0.014**	0.006
Diversification					-0.008*	0.004	-0.008**	0.004
Intercept	1.466*	0.825	1.335	1.073	0.186***	0.048	0.183***	0.067
Industry Dummies	Yes		Yes		Yes		Yes	
Year Dummies	Yes		Yes		Yes		Yes	
Number of observations	10,757		10,757		10,757		10,757	
Adjusted R-squared	0.424		n/a		0.539		n/a	

Panel C: Hedging and Excess Stock Return				
Explanatory Variables	Pooled OLS		Treatment Model	
	β	SE	β	SE
Change in Yield Spread	-1.264***	0.219	-1.268***	0.191
Change in Yield Spread × Hedging	0.588*	0.301	0.560**	0.274
Hedging	3.558***	0.814	7.464***	2.537
Change in Cash	0.005	0.043	0.005	0.041
Change in Operating Income	-0.016	0.025	-0.015	0.024
Change in Net Assets	0.079***	0.014	0.078***	0.013
Change in R&D Expense	4.071***	0.804	4.077***	0.737
Change in Capital Expenditure	0.947***	0.065	0.942***	0.063
Change in Dividends	10.254***	1.605	9.989***	1.807
Net Financing	-0.082***	0.026	-0.080***	0.026
Leverage	-0.633***	0.033	-0.635***	0.031
Intercept	3.973	6.836	1.494	7.242
Industry Dummies	Yes		Yes	
Year Dummies	Yes		Yes	
Number of observations	8,925		8,925	
Adjusted R-squared	0.154		n/a	

CHAPTER 2: GOVERNANCE STRUCTURE AND HEDGING POLICY

2.1 Introduction

The extant literature has recognized that overall corporate governance structure comprise two important components: shareholder governance represented by antitakeover provisions in corporate charters and by-laws and bondholder governance represented by debt covenants in contracts. (King and Wen, 2011; Johnson et al., 2009; Cremers and Nair, 2005; Klock et al., 2005; Gompers et al., 2003;) Due to the different nature of claims on the company's cash flows, potential conflicts between shareholders and bondholders emerge in the modern companies: Shareholders are entitled to claim all residual income after the bondholders are satisfied with the fixed payments. Particularly, risky projects offering high returns conforms to the interest of shareholders, whereas bondholders want to cover their fixed claims and avoid risky investments. Therefore, the governance structure between shareholders and bondholders affects managerial risk-taking. In this research we tend to "twine" these two aspects of corporate governances, and explore how shareholder rights and bondholder rights affect managerial hedging decision.

We follow Gompers et al. (2003) to calculate GIM index from Governance Legacy Data during 1993 to 2006. For the alternative measures, we also utilize the institutional blockholder ownership, the competition of board directors, E-index and CEO duality as alternative measures of shareholder governance. In terms of bondholder governance, in the spirit of Billett et al. (2007) and King and Wen (2011) we create a index of bondholder governance by grouping covenants and provisions into 15 major categories based on bond Data from 1993 to 2008. We also adopt the methodology from Wei (2008) and Toke and Wei (2009) to calculate J-index and W-index as alternative

proxies of bondholder governance. Regarding to managerial risk management, in particular, hedging decision, we include a dummy variable to reflect three types of hedging by using of foreign currency derivatives (FCDs), interest rate derivatives (IRDs) and commodity derivatives (CDs).

Based on the literature, three hypotheses are proposed to investigate in this research: (1) hedging overcomes the inefficient market and maximizes the firm value, so strong shareholder (bondholder) rights are positively related to the hedging decision. (2) Hedging mitigates the risk-shifting problem and facilitates conservative firm investments, so strong shareholder rights are negatively related to the hedging strategy, whereas strong bondholder rights are positively related to the hedging strategy. (3) Hedging is used by managers for private benefits or earnings management purpose, strong shareholder (bondholder) rights should be negatively related to the hedging strategy.

As the one of the first attempts to explore the influence of overall governance structure on corporate hedging decision, this research documents both strong shareholder rights and strong bondholder rights promote high hedging propensity, which support our first hypothesis that hedging overcomes the inefficient market and maximize the firm value and therefore strong shareholder (bondholder) rights are positively related to the hedging strategy. By using multiple alternative measures of shareholder rights and bondholder rights, and also controlling for the potential endogeneity, our main results keep robust. This paper also investigates if hedging mitigates the risk-shifting problem and then results in negative relation between hedging and shareholder rights whereas positive relation between hedging and bondholder rights. But no significant evidence is found to support this hypothesis. However, by exploring the influence of governance structure on hedging in different existing governance circumstance, we find modest empirical evidence which suggests that hedging can be used as a vehicle of earning management in the case of entrenched management and weak bondholder governance.

This paper proceeds as follows. Section 2 reviews the extant literature and the link between hedging and the governance structure. We also propose testable hypotheses in Section 2. In Section 3, we introduce data sources and definition of variables. Summary statistics are also provided. In Section 4 we mainly employ the univariate tests and multivariate regressions to study the impact of governance structure on hedging decision. We also estimate a simultaneous model with three equations as the robustness check. In Section 5, we further investigate the influence of governance structure on hedging in different subsamples. The main conclusions follow in Section 6.

2.2 Hedging Literature and Testable Hypothesis

Risk management, particularly hedging strategy, has become a critical dimension of corporate financial policy. A growing literature also emerges to provide theoretical justifications. One of the strands links the hedging behavior with the presence of market imperfections, such as deadweight costs related with bankruptcy risk (Smith and Stulz, 1985), aggressive tax region (Smith and Stulz, 1985), underinvestment due to high external financing cost (Froot, Scharfstein, and Stein, 1993). From those aspects, existing empirical research documents that hedging increases the firm value by overcoming these imperfections. For example, Nance, Smith and Smithson (1993) confirms the tax benefits of hedging. Chen and King (2013) and Campello et al. (2011) both show that hedging reduces the cost of financial distress, thereby lowering the cost of debt. Froot, Scharfstein and Stein (1993) documents that hedging mitigates the underinvestment problem as it ensures the availability of internally generated funds to avoid the high cost of external financing. By overcoming the imperfection of market, hedging is expected to contribute the firm value. Allayannis and Weston (2001) document a significant hedging premium as large as 4.87% of firm value for non-financial firms with total assets exceeding $500 million. Nelson, Moffitt, and Affleck-Graves (2005) report significant abnormal stock returns for currency hedgers, outperforming their peers by 4.3% per year. A higher

hedging premium of 10% is reported by Carter, Rogers, and Simkins (2006) when they examine the U.S. airline industry from 1992 to 2003. Similarly, Kim, Mathur, and Nam (2006) show that hedging increases firm value by 5.4% based on a sample of U.S. firms that hedge with currency derivatives.

Such value-maximizing function of corporate hedging raises a question that how hedging is affected by the shareholder rights. Serving as a part of governance mechanism, the shareholder rights are designed to protect shareholders' interest and increase the value. Strong shareholder rights will encourage firms to carry out the policy which maximizes the firm value, directly or indirectly. Therefore, we conjecture a positive association between the shareholder rights and hedging policy which aims to increase the firm value. On the other side, hedging also affects the bondholders value. Merton (1974) proposes that corporate debt can be regarded as a risk-free bond security less a put option, which has the firm as the underlying asset and the face value of the debt as the strike price. An increase in firm value leads to a decrease in the value of the put option and therefore an increase in corporate debt value. Graham, Li and Qiu, (2008) argue that high market value of firms provides more claimable assets over book assets to creditors in the case of insolvency. Following these theories, we propose that bondholder rights will also sponsor hedging policy. As a combination of both , we develop the first hypothesis as below:

Hypothesis 1: Hedging overcomes the inefficient market and maximizes firm value, so strong shareholders (bondholder) rights are positively related to the hedging strategy.

The second strand of hedging literature discusses the benefits of hedging from agency problem theory. The first aspect is based on the conflict between shareholder and bondholder. Jensen and Meckling (1976) point out that the equity value of levered firms can be viewed as European call option (e.g., Merton, 1974) with an exercise price equal to the face value of the debt. Therefore the value of the call option is an increasing

function of the variance of the underlying firm value. The theory of risk-shifting suggests that shareholders tend to increase firm risk after raising debt capital by investing in risky but negative NPV project. By taking more risks, shareholders harvest the benefits if projects perform well, but bondholders bear the costs if the opposite occurs. Hedging can alleviate the risk-shifting problem by reducing the probability of default and earnings volatility. Campbell and Kracaw (1990) argue that hedge can provide credible commitments to lenders by reducing borrowers' incentive to shift risk after the contracts are signed. Meanwhile, they also suggest that it may be optimal for bondholders to include covenants which require that the borrower hedge an observable risk in debt contracts. Since hedging prevents bondholders from being exploited while caps shareholders' the upward potentials, we expect find that strong shareholder right discourages hedging, but strong bondholder right boosts hedging. To sum, we form the second hypothesis as follows:

Hypothesis 2: Hedging mitigates the risk-shifting problem and facilitates conservative firm investments, so strong shareholder rights are negatively related to the hedging strategy, whereas strong bondholder rights are positively related to the hedging strategy.

The third strand links "selective hedging" where hedging is manipulated by managers for their private benefits. The motivation of selective hedging is in line with the discussion from Brown et al. (2006), Heaton (2002), and Shefrin (2001) that if overconfident managers tend to believe that they are super competent or have exclusive information which the market does not have, managers relying on overoptimistic views may in fact destroy the firm value. This practice is called "selective" hedging by Stulz (1996). Although it may be possible that in some cases selective hedging can bring positive values if managers actually have advantage of information or are lucky to correctly predict the market movement, overconfident managers who indulge in

"selective hedging" will deviate from the purpose of risk management, merely resulting in an increase of firms risk but rather ultimately destroying the firm value. Managers use hedging as a substitute for earnings management (Brown, Crabb and Haushalter, 2006; Barton, 2001; Pincus and Rajgopal, 2002). Barton (2001) suggests that managers use derivatives and discretionary accruals as substitute tools to smooth accounting earnings. Pincus and Rajgopal (2002) indicate that even after controlling for well-documented determinants of hedging strategy, the managers are still found to use hedging strategy as a substitute mechanism of smoothing the income with discretionary accruals. As mentioned by Brown et al. (2006) that shareholder rights provide shareholders the capability to remove those opportunistic managers who use inside information to manipulate or distort the real firm performance. The evidence also suggests that managers with more restrictions against shareholders participation have greater propensity to commit accounting misstatements. A negative relation is found between the independence of the audit committee and the abnormal accruals, and the similar negative relation is also reported between board independence and the abnormal accruals. An similar view suggests that strong bondholder rights could reduce hedging as a way of earnings management since managers have incentive to manipulate earnings to avoid debt covenant violations. As a result, we propose our third hypothesis below:

Hypothesis 3: Hedging is used by managers for private benefits or earnings management purpose, strong shareholder(bondholder) rights should be negatively related to the hedging strategy.

2.3 Sample Selection and Variable Construction

2.3.1 Sample Selection

This paper studies the influence of governance structure, in particular, shareholder governance and bondholder governance, on firm hedging policy from 1993 to 2008, therefore we start our sample collection with the data of shareholder governance and

bondholder governance. Gompers, Ishii, and Metrick (2003) construct a well-known governance index (GIM index) as a proxy for shareholder rights.[24] As the most comprehensive database describing the firm-level shareholder rights, each of the IRRC publication covers all S&P 500 firms. Since 1998 many small firms which are not included in S&P 500 are also collected by the IRRC (Bebchuk, Cohen,and Ferrell, 2009). As a result, the firms in IRRC accounts for more than 90% of the total capitalization of the U.S. stock market. Consequently, following the literature, our main dataset of shareholder rights is from RiskMetrics (Governance Legacy Data) from 1993 through 2006. To retrieve the information of bondholder governance, we adopt the methodology developed in Billett, King and Mauer (2007) and King and Wen (2011) to use the covenants of publicly-traded bonds from Mergent's Fixed Income Securities Database (FISD) database. The FISD database provides all the characteristics of the individual bonds such as coupon, maturity, ratings, and more importantly, detailed information about bond covenants which are used as a mechanism in bond contact to protect bondholders (Cremers, Nair, and Wei (2007) and Billett, King, and Mauer (2007)). The FISD records the incidence of more than 50 different covenants in a large number of public bonds issues by nonfinancial firms since 1960s. Smith and Warner (1979) is the first attempt to broadly analyze the influence of restrict covenants on the conflicts between stockholders and bondholders, such as the covenants limit the payment of dividends, the covenants restrict financing and additional debt borrowing, and also the covenants curb certain types of investments and M&A activities. Additionally, Myers (1977) and Kalay (1982) point out that other covenants, e.g., event-risk covenants, are designed to protect bondholders from by the default risk of outstanding debt.

[24] The IRRC has published data in 1990, 1993, 1995, 1998, 2000, 2002, 2004, and 2006. We assume that firms maintain the previous publication's provisions in between publication dates (see Gompers et al.,2003; Masulis et al., 2007). Because the IRRC did not publish volumes in each year, we assumed that firms' governance provisions as reported in a given IRRC volume were in place during the period immediately following the publication of the volume until the publication of the subsequent IRRC volume. Using a different "filling" method, however, does not change our results.

We identify corporate hedging activities reported in 10-K filings by using the Securities and Exchange Commission (SEC) EDGAR database. Specifically, we perform a keyword searching in 10-K reports compiled in EDGAR from 1993 to 2008. In this research, We include three types of derivatives as the measure of hedging to consider the usage of foreign currency derivatives (FCDs), interest rate derivatives (IRDs) and commodity derivatives (CDs), which are the most commonly used hedging instruments by non-financial US firms. Taking hedging behaviors with Foreign Currency Derivatives (FX) for example, the set of keywords include: currency derivative, currency swaps, currency forwards, currency futures, currency options, currency contract, currency forward contract, exchange forward, exchange future, exchange swap, exchange option, exchange contract, or forward exchange contract. For each keyword found, we review the context in which the keyword appears in the report to confirm the use of derivatives for hedging. Following Nance, Smith, and Smithson (1993) and Geczy, Minton, and Schrand (1997), we use a dummy variable to represent if a firm hedges in a given year. In particular, the dummy variable for hedging equals one in a given year if a firm holds a hedging position at the end of the fiscal year or has transactions involving hedging during that year, and zero otherwise. Combination of these datasets results in a sample of firm-level for firms.

To incorporate firm characteristics and managerial incentive as suggested in literature in the analysis, we require sample firms to have financial information in COMPUSTAT, CEO compensation data in EXECUCOMP, and stock prices in CRSP. After merging all these datasets, we get our final sample of 8,286 firm-year observations from 1,204 unique firms from 1993 through 2008.

2.3.2 Shareholder Governance Measure

Our main measure of shareholder governance is following Gompers et al. (2003) who construct a firm-level governance index (hereafter “GIM Index”) based on the

prevalence of 24 antitakeover provisions and they find that firms with stronger shareholder rights (a lower GIM Index) have higher equity and firm values. The IRRC survey and publish data in 1990, 1993, 1995, 1998, 2000, 2002, 2004, and 2006. Following the convention in literature, we fill in the data between those reporting year. e.g. GIM index in 2006 for the year from 2007 through 2008.

Besides GIM index, the literature also suggest other proxies to measure shareholder right. Bebchuk, Cohen and Ferrell (2009) find a smaller set of provisions dominates the results for a governance index. They calculate this index by including only 6 of 24 antitakeover provision and document that high value of this index denotes less shareholder right or more managerial entrenchments (hereafter referred, "E-index."). Institutional investors, particularly blockholders, have an strong incentive to actively monitor executives' decisions of corporate financing and investment policies as they have a larger stake on the firm. We use the percentage of stock ownership held by institutional blockholders as a proxy for the incentive of outside stockholders to monitor the managers. Therefore, a blockholder is defined as a stockholder who hold at least 5% of the firm's equity, and hence the existing of blockholders would indicate the considerable incentives and capability of institutional investors to monitor managerial risk-attitude and decision making. Following the approach of Coles et al. (2009) we calculate independent board ratio as the percent of outsiders on the board, who refer to non-employed directors or non-linked directors. Accordingly, dependent board ratio is the percent of insiders on the board who are identified as employed directors or linked directors. We also define a relative measure of the power between outside directors and inside directors, board director competition, as the independent board ratio minus dependent board ratio. Finally, CEO duality has been consistently recognized as a conflict of interest in corporate governance. Ho and Wong (2001) assert that firms with the same individual serving as both chairman and CEO (i.e., CEO duality) are considered to be more managerially

dominated or less shareholder rights. We adopt this measure by defining a dummy variable which takes the value of one if in a given firm board chair and CEO are the same individual.

2.3.3 Bondholder Governance Measure

Following Billett et al. (2007) we collect 35 covenants and group them into the 15 covenant categories in bond contracts to create firm-year index (FBX-index) of covenant protection. FBX-index ranges from 0 to 15 theoretically, and high FBX-index denotes strong debt holder governance.[25] In the spirit of King and Wen (2011), 6 sub-indexes by grouping 15 covenant categories include payout sub-index (two covenant categories), financing sub-index (seven covenant categories), investment sub-index (three covenant categories), control sub-index (one covenant category), trigger(1) and cross-default sub-index (one covenant category)

In addition, we adopt two alternative measures from Wei (2008) and Toke and Wei (2009), where J-index and W-index are used to measure bondholder right. Although two indices are both based on FIDS bond covenants, they are constructed differently. J-index is based on 28 covenants. The value of J-index is computed as the total number of covenants in each contract. J-index is a clear-cut way to capture the covenant intensity in each bond contract. By treating each covenant with equal weight, this method ignores the possible complement or substitute effect among different covenants. To partially address this issue, 28 covenants first are grouped into five categories: production/investment, dividend, financing, default-related, and event-related. 1) production/investment (nine units), 2) dividend (two units), 3) financing (twelve units), 4) default-related (two units), and 5) event-related (three units). W index is calculated as the number of covenant categories which have covenant member(s) included in the indenture. By definition, W

[25] For each debt issue, the FISD reports the incidence of over 50 different bondholder protective and issuer restrictive covenants. Following Billett et al. (2007) and King and Wen (2010), we identify covenants that are related to financing, investment, and event risk and group these covenants into 15 major categories.

index ranges between 0 (weak) and 5 (strong). Using this approach, we expect that firms with a high J-index/W-index means have more bondholder rights.

2.3.4 Hedging Related Variables

Existing research suggests that hedging decision is related with other economic rationales, such as, reduction in risk exposure (Smith and Stulz, 1985),a lower expected taxes (Smith and Stulz, 1985), a lower possibility of financial distress (Smith and Stulz, 1985), and mitigation of underinvestment problem by increasing the likelihood that the firms finance projects through cheap internal capital. As discussed in literature that the risk exposure of firms will highly affect the inclination of using hedging decision. I use the foreign sales ratio and floating debt ratio as proxies for the foreign currency risk and interest rate risk. foreign sales ratio is defined as the ratio of foreign sales to total sales, and we follow Chava and Purnanandam (2007) to calculate floating debt ratio as the sum of short-term debt and long-term debt tied to prime divided by total debt for a given firm. Tax saving incentive is associated with a five percent reduction in the volatility of taxable income and the calculation is based on the equation developed in Graham and Smith (1999). Graham and Smith use simulation to illustrate that this proxy is more precise to capture the shape of tax function than tax loss carry-forward. Following Gay and Nam(1998), a correlation between cash flow and investment expense is calculated as the correlation coefficient of cash flow and investment expense. The calculation of cash flow is operating income before depreciation - interest expense - (income taxes-deferred tax change) - common dividends preferred dividends. The investment expense is defined as the sum of capital expenditure, R&D expense and net PP&E. To consider the possibility of natural hedging as the alternative of financial hedging, namely holding cash to reduce the negative impact of business uncertainty on firm operation, we include cash holding in our analysis, which is defined as the sum of cash and short term security scaled by total

assets. We control for other firm characteristics, including firm size, leverage and growth opportunities.

2.3.5 Summary Statistics

Based on the sample of 8,286 firm-year observations, we examine the stockholder governance, the bondholder governance and the impacts of governance structure on the hedging behavior from 1993 to 2008. We winsorize firm level variables at the 1% and 99% of the sample to reduce the potential outliers. Table 1 provides the summary statistics for our sample. Approximately 59% of the sample firms are classified as hedgers to use hedging. Among different hedging strategy, we find interest rate hedging and foreign currency hedging are most commonly used, accounting for 47% and 39%, while 15% firm-years mark with commodity hedging. The average GIM index of sample firms are 9.44. The blockholders hold 14% firm equity on average, and independent board directors dominates (69%) in the boards, and consistently, independent board directors owns more seats than dependent board directors. The sample firms have a mean (median) value of E-index with 1.56 (2), which suggests managerial entrenchment is not severe for the firms in our sample. But the variable of CEO duality indicates that the CEO and the chairman of the board are the same person in 80% more than firm-years. Across the measures of bondholder governance, we find a consistent result that both FBX index and J index have a mean value of around 4, and a median value of 3 or 4. Additionally, we find CEO delta and vega measure has a value of 0.18 and 0.03 of total compensation. On average, foreign sales account for 28% of total sales and 24% of debt is identified as floating-rate debt. The correlation coefficient between cash flow and investment opportunity is about 33%, and 5% reduction in taxable income will bring $2.09 million of tax saving. Regarding to other control variables, we find our sample firms have cash holding accounting for 9% of total assets, 23.41% firm assets are financed by debt capital, and the mean value of market-to-book ratio is around 1.74.

2.4 Empirical Results

2.4.1 Univariate Tests

Since the purpose of this paper is to study the influence of governance structure on corporate hedging policy, and test the hypotheses that predict the different relationship between stockholder governance/bondholder governance on hedging decision. To do so, we first present hedging decisions by comprehensive measures of governance and also other stylized determinants. Table 2 shows the comparison of hedging propensity based on groups of governance measures and other proxies of hedging determinants. For example, we divide the total sample of 8,286 firm-years into above-median group and below-median group based on the median value of stockholder power (1-GIM/24). There are 5,262 firm-years in the above-median group with the mean value of hedging dummy 0.596, which suggests that 59.6% of firm-years with strong stockholder power are hedgers. In contrast, only 57.5% of firm-years with weak stockholder power are hedgers. We also observe a significant difference between two groups of 2.1% in hedging propensity. Moreover, if we use other measures and find the similar results. The firms with high blockholder ownership have 6.3% higher in the possibility of hedging than those with low blockholder ownership, and the firms with more independent board directors relative to dependent board directors have 1.3% higher in the possibility of hedging than those with few independent board of directors. Such evidence from univariate tests support the part of our hypothesis one that strong shareholder rights will encourage more hedging behaviors. Interestingly, the univariate tests based on E-index and CEO duality also show that the firms with more managerial entrenchment tend to hedge more,1.4% higher from E-index grouping and 10% from CEO duality. Although the result in E-index is weakly significant, we suspect that these two measure may capture less information about governance since both them have less variation.

On the other side, we also use FBX index, J-index and W-index to explore the bondholder governance. We follow the same procedure to split the sample into above-median group and below-median group based on these three bondholder governance measures. The univariate comparison shows that the firms with strong bondholder rights are more likely to hedge. For example, the likelihood of hedging for the firms with high FBX index is 2.1% higher than that of firms with low FBX index. The consistent differences are also observed for J-index and W-index grouping. Given the results of all significant difference in means, our conjecture that strong bondholder rights will boost hedging strategy is supported.

Additionally, we further divide the sample into groups based on various well-documented rationales of hedging to investigate how those firm characteristics affect the hedging decision. We find that the firms where CEOs have more incentive from delta (volatility of compensation with respect to stock price) tend to hedging more. But we also find firms where CEOs have more incentive from vega (volatility of compensation with respect to volatility of stock return) tend to hedging more, which is opposite to the predictions in literature since Vega incentive will increase the managerial risk-taking and decrease the inclination of hedging. As regards to the measures of risk exposures from foreign currency and interest rate, we find consistent results that more risk exposures increase the possibility of hedging. The underinvestment effect and tax benefit effect are also supported in univariate test that firms with low correlated cash flow and investment opportunity or more tax saving from smoothes net income are more likely to hedging. To include the univariate comparison, we generally find the evidence which supports our first hypothesis and is also consistent with the literature in terms of well-documented rationales of hedging.

2.4.2 Baseline Multivariate Tests

The univariate results in the previous section demonstrate an positive association between both shareholder rights and debtholder power and the hedging strategy. However, hedging decision may be also simultaneously affected by other firm characteristics (such as firm size, leverage or the level of growth opportunities) and the drivers of hedging rationales faced by the firm. We address this possibility by employing the analysis of the previous section to a multivariate framework. Therefore, by including control variables for these characteristics we attempt to ensure that we are capturing the true marginal effect of governance structure on hedging decision. In each regression specification we first include proxies of stockholder power (1-GIM/24) and bondholder rights (FBX/15), and also include a common set of control variables. We control for firm size as scale economies in implementing hedging strategy, firm leverage and market-to-book ratio as proxies of capital structure and firm growth opportunities. In addition, in model 2 we control for equity compensation incentive by including logarithmized value of CEO delta incentive and CEO vega incentive, and control for alternative hedging strategy by incorporating cash holding as the proxies of natural hedging. In model 3 we consider to other hedging determinants which have been proposed in literature, namely, the ratio of foreign sale to total sales as the measure of foreign currency risk exposure and the ratio of floating rate debt to total debt as the measure of interest rate risk exposure. We also consider the underinvestment effect and tax benefit effect by including the correlation of cash flow and investment opportunity and tax convexity, respectively. We use the Fama-French 48 industry categories to create industry dummy variables, which are included for industry effects. The year dummies are also created to control the variation of hedging over the time. Our multivariate regression model is structured as Equation (2.1) below:

Hedging = α + β1×Stockholder Rights + β2× Bondholder Rights + β3×Log (CEO Delta) + β4×Log (CEO Vega) + β5×Foreign Sales/Total Sales +β6×Floating-rate Debt/Total Debt+β7×Corr(CF, Investment) + β8×Tax Convexity +β9×Cash&Cash Equivalent/Total

Assets+β10×Log(Total Assets)+β11×Leverage+β12×Market-to-book+Industry Dummies +Year Dummies + ε (2.1)

To analyze the impact of governance structure on hedging/non-hedging decision, we first run the Probit model by regressing dummy variable of hedging on the explanatory variables. Table 3 reports the results of Probit model with the hedging dummy as the independent variable. Across the models, we find both stockholder power and bondholder rights have significant and positive effects on hedging dummy, which support our first hypothesis that both strong governances will promote the firms to implement hedging strategy. This result also suggests that hedging is mainly functioning as a value-maximization device to both shareholders and bondholders. From Table 3, we also find a significantly positive relation between CEO delta incentive and hedging, and a negative relation between CEO vega incentive and hedging. These two results are consistent with the theoretical predictions that CEO delta represents the value-creating incentive of compensation while the CEO vega represents the risk-taking incentive of compensation. The proxies of risk exposure also show the consistent results that the firms with more foreign sales and the firms with more floating-rate debts are more likely to hedge. The significantly negative coefficient of the correlation is found to suggest that the firms tend to hedge when the firms' internal cash flow generation does not match the capital demand of investment. Moreover, tax convexity is also positively correlated with hedging decision under one percent significance level, indicating that the reduction of expected tax encourages firms to implement hedging strategy. Regarding to other controls, we find the large firms, the firms with high financial leverage and the firms with higher market-to-book ratio are more likely to hedge.

To facilitate the interpretation of regression results, in Panel B of Table 3 we report the marginal effects on the probability of implementing hedging strategy for a one standard deviation change in continuous explanatory variables. Z-values based on robust

standard errors are reported in parentheses below to test whether the coefficients of marginal effects are equal to zero. Consistent with the theoretical prediction, we observe a strong evidence that governance structure has important impact on hedging strategy. For example, in model 3 after controlling for other determinants of hedging, we find that one standard deviation increase in the measure of stockholder power will increase the possibility of hedging by 25.3%, and one standard deviation increase in the measure of bondholder rights will increase the possibility of hedging by 7.8%.

2.4.3 Robustness Tests

Considering the potential issue associated with measuring stockholder governance and bondholder governance, we employ two robustness tests. In the first test, we adopt two sets of different proxies of stockholder governance and bondholder governance. As discussed in Section 2.2, we use J-index and W-index as alternative proxies of bondholder rights, and use blockholder ownership, board director ratio, E-index, and CEO duality as alternative proxies of stockholder power. To address potential endogeneity issue involved among shareholder governance, bondholder governance and hedging decision, we implement a simultaneous equations model (SEM) to estimate a system where shareholder governance, bondholder governance and hedging decision are allowed to affect interactively.

The results of marginal effects on the probability of hedging decision based on Probit model are reported in the Panel A of Table 4. On Model 1, we replace the measure based on FBX index with the measure based on J-index and find that the relation between stockholder power and hedging decision keeps significantly positive, and meanwhile the bondholder rights measured by J-index also shows a significantly positive impact on the hedging decision. The similar results are detected from Model 2 when the bondholder rights are measured by W-index. Consistent results indicate that bondholders prefer conservative corporate policies and tend to urge more hedging as bondholders have more

influence on corporate operations. From Model 3 through Model 6, we keep the main measure of bondholder rights, i.e. FBX index divided by 15, but try alternative measures of shareholder rights: blockholder ownership, competition of board director, E-index and CEO duality. We find the significantly positive correlation between hedging decision and blockholder ownership, and significantly positive correlation between hedging decision and board director competition. Given that both higher blockholder ownership and more independent board directors suggest more stockholder power, the results from Model 3 and Model 4 confirm our hypothesis one that the hedging strategy is favorable to stockholders. On Model 5 the E-index measuring managerial entrenchment is negatively correlated with hedging under ten percent significance level. This result is consistent with the prediction of hypothesis one since more entrenched managers means weak shareholder rights.

The goal of our research is to find how governance structure affects hedging decision. The protection of stakeholders has been documented to be substantially important for risk-taking activities of mangers. Such protection mechanism includes antitakeover provisions, board composition and institutional investors monitoring from shareholders' interest, and bond covenants from debtholders' interest. In the context of managerial entrenchment, risk-averse managers choose conservative investment policy (hedging) to secure their private benefits and maximize their utility. The interaction among shareholder governance, bondholder governance and managerial behavior can be linked to the conflicts of interest between value-maximum shareholders and risk-averse mangers, and the conflicts of interest between fixed-claiming debtholder and residual-claiming shareholders. All these imply that it is important to implement a thorough analysis about the impact of overall corporate governance structure on managerial hedging activities by controlling for endegeneity concern. A system of simultaneous equations is a reasonable methodology to deal with this issue. Our simultaneous

equations model is similar with King and Wen (2011), except that we focus on firm active hedging instead of conservative investment. The SEM regression model for hedging and the governance structure is as follows:

$$\begin{aligned}\text{Hedging} = {} & \alpha + \beta1\times\text{Stockholder Rights} + \beta2\times \text{Bondholder Rights} + \beta3\times\text{Log (CEO Delta)} \\ & + \beta4\times\text{Log (CEO Vega)} + \beta5\times\text{Cash\&Cash Equivalent/Total Assets} \\ & + \beta6\times\text{Log(Total Assets)} + \beta7\times\text{Leverage} + \beta8\times \text{Market-to-book} \\ & + \text{Industry Dummies} + \text{Year Dummies} + \varepsilon \qquad (2.2)\end{aligned}$$

$$\begin{aligned}\text{Bondholder Rights} = {} & \alpha + \beta1\times\text{Hedging} + \beta2\times \text{Stockholder Rights} + \beta3\times \text{Debt Maturity} \\ & + \beta4 \times \text{Convertibles} + \beta5\times\text{Cash\&Cash Equivalent/Total Assets} \\ & + \beta6\times\text{Log(Total Assets)} + \beta7\times\text{Leverage} + \beta8\times \text{Market-to-book} \\ & + \text{Industry Dummies} + \text{Year Dummies} + \varepsilon \qquad (2.3)\end{aligned}$$

$$\begin{aligned}\text{Stockholder Rights} = {} & \alpha + \beta1\times\text{Hedging} + \beta2\times \text{Bondholder Rights} + \beta3\times \text{Volume} \\ & + \beta4 \times \text{Delaware Incorporation} + \beta5\times\text{Cash\&Cash Equivalent/Total Assets} \\ & + \beta6\times\text{Log(Total Assets)} + \beta7\times\text{Leverage} + \beta8\times \text{Market-to-book} \\ & + \text{Industry Dummies} + \text{Year Dummies} + \varepsilon \qquad (2.4)\end{aligned}$$

Panel B of Table 4 represents the results of SEM regression. From hedging dummy equation we observe significantly positive coefficients for stockholder power and bondholder rights, which confirm the results that we find from the baseline models. Either strong influence of stockholders or strong influence of bondholders will increase the probability of hedging. Additionally, from bondholder rights column and stockholder power column, we find more hedging leads to less power for bondholders and stockholders. Interestingly, in the framework of SEM, we find stockholder power also

has positive impact on bondholder rights. This positive relation is in line of one view in literature that low GIM index represents few anti-takeover provisions, which is regarded as a threat to bondholders since Cremers et al. (2007) point out that bondholders impose more bond covenants to protect themselves from takeover risk. Therefore a positive relation from shareholder rights and bondholder rights provides the evidence to support this argument. On the other side we do not find significant influence of bondholder rights on the shareholder, but the relation between bondholder rights and shareholder rights keeps consistently positive.

2.5 Extended Analysis

Although a significant and positive relation between hedging and both shareholder rights and bondholder rights is documented in baseline model and robustness model, another important question is that how this relation varies in a given circumstance of governance structure. We explore this question by grouping our sample into two subsamples based on the median value of stockholder governance, and two subsamples based on the median value of bondholder governance. For each of four subsamples we run the baseline Probit model regressions and report the results in Table 5. From Model 1 and Model 2, we find that for the sample with strong stockholder governance hedging decision remains a significantly positive relation with both stockholder governance and bondholder governance, while such positive correlation becomes insignificant for the sample with weak stockholder power. These results suggest that stockholder governance works as an important mechanism not only in regulating managerial risk-taking, but also reconciling the relations between bondholders' influence and managerial decision-making. Both insignificant coefficients of stockholder rights and bondholder rights in Model 2 indicate that hedging is not used to maximize the firm (all stakeholders) value when managerial entrenchment is severe.

On the other side, we find distinct results when the sample is divided by bondholder governance. From Model 3, the stockholder power shows significantly positive impact on hedging decision when the companies have strong bondholder rights in place. This suggests that stockholders have more incentive to implement hedging when incumbent bondholders impose more constraints. One potential interpretation is that stockholders tend to use more hedging strategy as commitments for bondholders when the firms invest on risky projects and bondholders use more protective covenants. More interestingly, Model 3 shows that in the situation of a weak existing bondholder governance bondholder rights have significantly negative impact on hedging and stockholder power has insignificantly negative impact on hedging. Recall our third hypothesis that managers can use hedging to manipulate the earnings, these negative relations detected from Model 4 will provide modest evidence to support this hypothesis. Given less control on managers decision and possibility of hedging being used as earnings management, the bondholders will oppose the using of hedging strategy.

2.6 Conclusions

In this paper we study the influence of governance structure including both shareholder governance and bondholder governance on hedging decision by using a sample of US firms from 1993 to 2008. We detect a significant relation between firm hedging decision and governance structure after controlling for well-documented rationales in literature.

Our results document both strong shareholder rights and strong bondholder rights promote high hedging propensity, which support our first hypothesis that Hedging overcomes the inefficient market and maximize firm value, so a strong shareholder (bondholder) right is positively related to the hedging strategy. By using multiple alternative measures of shareholder right and bondholder right, and also controlling for potential endogeneity, our main results keep robust.

This paper also investigates if hedging mitigates the risk-shifting problem and then results in negative relation between hedging and shareholder right while positive relation between hedging and bondholder right. But no evidence is found to support this hypothesis. However, by exploring the influence of governance structure on hedging in different existing governance circumstance, we find modest empirical evidence which suggests that hedging can be used as a vehicle of earning management in the case of entrenched management and weak bondholder governance.

Table 2.1: Summary statistics

This table reports summary statistics of hedging dummy, governance structure and other explanatory variables for the sample of 8,286 firm-year observations from 1993 through 2008 with winsorization at the 1th and 99th percentiles.

Variables	N	Mean	Median	Std. Dev.	P25	P75
General Hedging (Dum)	8,286	0.59	1.00	0.49	0.00	1.00
Foreign Currency Hedging (Dum)	8,286	0.39	0.00	0.49	0.00	1.00
Interest Rate Hedging Hedging (Dum)	8,286	0.47	0.00	0.50	0.00	1.00
Commodity Hedging (Dum)	8,286	0.15	0.00	0.36	0.00	1.00
GIM Index	8,286	9.44	9.00	2.66	2.00	16.00
Blockholder Ownership	8,286	0.14	0.12	0.14	0.00	0.55
Board Director Competition (Indep. - Dep.)	6,120	0.51	0.57	0.24	-0.22	0.85
E-Index	8,286	1.56	2.00	1.12	0.00	5.00
CEO Duality	6,120	0.81	1.00	0.39	0.00	1.00
FBX Index	8,286	4.28	4.00	2.90	0.00	12.00
J-Index	8,286	3.88	3.00	3.34	0.00	14.00
W-index	8,286	2.49	3.00	1.55	0.00	5.00
CEO Delta/Total Compensation	8,286	0.18	0.05	0.56	0.00	4.58
CEO Vega/Total Compensation	8,286	0.03	0.02	0.03	0.00	0.20
Foreign Sales/Total Sales	8,286	0.28	0.18	0.33	0.00	1.50
Floating-rate Debt/Total Debt	8,286	0.24	0.16	0.25	0.00	1.00
Corr(CF, Investment)	8,286	0.33	0.42	0.49	-0.90	0.98
Tax Convexity (M$)	8,286	2.09	1.68	1.74	-0.25	7.12
Cash & Cash Equivalent /Total Assets	8,286	0.09	0.04	0.13	0.00	0.67
Log (Total Assets)	8,286	8.20	8.08	1.32	5.46	11.63
Leverage (%)	8,286	23.41	20.50	14.88	1.22	68.64
Market-to-book Ratio	8,286	1.74	1.45	0.94	0.80	6.45

Table 2.2: Univariate tests

This table provides an univariate analysis of probability of hedging by categorizing the proxies pertaining to stockholder rights and bondholder rights in Section 3, and by other hedging determinants proposed in literature.

Grouping Variables	N Above Median	Mean Above Median [1]	N Below Median	Mean Below Median [2]	Diff. in Mean (1) – (2)
Stockholder Rights (1-GIM/24)	5,262	0.596	3,024	0.575	0.021**
Blockholder Ownership	4,143	0.620	4,143	0.557	0.063***
Board Director Competition (Indep. - Dep.)	3,061	0.625	3,059	0.612	0.013
E-Index	4,222	0.595	4,064	0.581	0.014*
CEO Duality*	4,957	0.637	1,163	0.537	0.100***
FBX Index	5,377	0.595	2,909	0.575	0.021**
Bondholder Rights (J-index/28)	5,507	0.596	2,779	0.574	0.022**
Bondholder Rights (W-index/5)	4,242	0.601	4,044	0.576	0.025***
CEO Delta/Total Compensation	4,143	0.637	4,143	0.540	0.098*
CEO Vega/Total Compensation	4,143	0.668	4,143	0.509	0.158***
Foreign Sales/Total Sales	4,143	0.670	4,143	0.507	0.163***
Floating-rate Debt/Total Debt	4,143	0.631	4,143	0.546	0.086***
Corr(CF, Investment)	4,143	0.580	4,143	0.597	-0.017*
Tax Convexity (M$)	4,143	0.598	4,143	0.579	0.019**

Table 2.3: Baseline models of impact of governance structure on hedging

This table shows the results of baseline regression of hedging activity for the sample of 8,286 firm-years from 1993 through 2008. Panel A reports the probability of hedging from Probit model and Panel B reports the marginal effects on the probability of hedging for a one standard deviation change in continuous explanatory variables. We control for industry effects by using the Fama-French 48-industry classification and control for time effects by using year dummies. The robust standard errors are used to calculate Z-Statistics or t-Statistics that are reported in parentheses below estimates. *, ** and *** denote significance at the 10, 5 and 1 percent level, respectively.

Panel A: Probit Model				
		[1]	**[2]**	**[3]**
Stockholder Rights (1-GIM/24)	+/-	0.689***	0.790***	0.653***
		(4.680)	(5.274)	(4.274)
Bondholder Rights (FBX/15)	+/-	0.244***	0.185**	0.200**
		(2.783)	(2.082)	(2.236)
Log (CEO Delta)	+		0.029***	0.039***
			(2.769)	(3.622)
Log (CEO Vega)	-		-0.008	-0.011
			(-0.706)	(-0.988)
Foreign Sales/Total Sales	+			0.497***
				(7.854)
Floating-rate Debt/Total Debt	+			0.336***
				(5.102)
Corr(CF, Investment)	-			-0.086**
				(-2.548)
Tax Convexity	+			0.042***
				(4.090)
Cash & Cash Equivalent /Total Assets	-		-0.832***	-0.872***
			(-5.295)	(-5.397)
Log (Total Assets)	+	0.242***	0.206***	0.195***
		(17.832)	(13.253)	(12.116)
Leverage	+	0.007***	0.007***	0.006***
		(5.139)	(4.929)	(4.119)
Market-to-book Ratio	+	0.104***	0.106***	0.102***
		(4.804)	(4.827)	(4.628)
Constant		-4.017***	-3.817***	-3.847***
		(-13.804)	(-12.628)	(-12.564)
Industry Control		Yes	Yes	Yes
Year Control		Yes	Yes	Yes
Number of observations		8,286	8,286	8,286
Pseudo R2		0.221	0.225	0.236

Panel B: Margin Effect of Probit Model				
		[1]	[2]	[3]
Stockholder Rights (1-GIM/24)	+/-	0.267***	0.306***	0.253***
		(4.682)	(5.275)	(4.274)
Bondholder Rights (FBX/15)	+/-	0.095***	0.072**	0.078**
		(2.783)	(2.082)	(2.236)
Log (CEO Delta)	+		0.011***	0.015***
			(2.768)	(3.621)
Log (CEO Vega)	-		-0.003	-0.004
			(-0.706)	(-0.988)
Foreign Sales/Total Sales	+			0.192***
				(7.860)
Floating-rate Debt/Total Debt	+			0.130***
				(5.103)
Corr(CF, Investment)	-			-0.033**
				(-2.548)
Tax Convexity	+			0.016***
				(4.089)
Cash & Cash Equivalent /Total Assets	-		-0.323***	-0.337***
			(-5.290)	(-5.391)
Log (Total Assets)	+	0.094***	0.080***	0.075***
		(17.778)	(13.230)	(12.097)
Leverage	+	0.003***	0.003***	0.002***
		(5.138)	(4.928)	(4.119)
Market-to-book Ratio	+	0.040***	0.041***	0.040***
		(4.805)	(4.827)	(4.628)
Industry Control		Yes	Yes	Yes
Year Control		Yes	Yes	Yes
Number of observations		8,286	8,286	8,286
Pseudo R2		0.221	0.225	0.236

Table 2.4: Robustness check of impact of governance structure on hedging

This table reports the results of robustness checks from alternative governance measures (Panel A) and simultaneous equation model (Panel B). We control for industry effects by using the Fama-French 48-industry classification and control for time effects by using year dummies. The robust standard errors are used to calculate Z-Statistics that are reported in parentheses below estimates ∗, ∗∗ and ∗∗∗ denote significance at the 10, 5 and 1 percent level, respectively.

Panel A: Alternative Governance Measures							
		[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**
Stockholder Rights (1-GIM/24)	+/-	0.639***	0.654***				
		(4.177)	(4.281)				
Blockholder Ownership	+/-			0.477***			
				(3.847)			
Board Director Competition (Indep. - Dep.)	+/-				0.355***		
					(3.912)		
E-Index	+/-					-0.026*	
						(-1.802)	
CEO Duality	+/-						0.066
							(1.327)
Bondholder Rights (FBX/15)	+/-			0.213**	0.012	0.201**	0.007
				(2.387)	(0.113)	(2.247)	(0.061)
Bondholder Rights (J-index/28)	+/-	0.487***					
		(3.287)					
Bondholder Rights (W-index/5)	+/-		0.136**				
			(2.443)				
Log (CEO Delta)	+	0.039***	0.039***	0.038***	0.034**	0.039***	0.036**
		(3.632)	(3.635)	(3.554)	(2.470)	(3.635)	(2.574)
Log (CEO Vega)	-	-0.011	-0.012	-0.019	-0.017	-0.016	-0.025*
		(-0.919)	(-0.996)	(-1.593)	(-1.237)	(-1.384)	(-1.773)
Foreign Sales/Total Sales	+	0.500***	0.495***	0.511***	0.507***	0.501***	0.508***
		(7.893)	(7.823)	(8.065)	(6.704)	(7.891)	(6.713)
Floating-rate Debt/Total Debt	+	0.334***	0.339***	0.346***	0.377***	0.343***	0.379***
		(5.066)	(5.141)	(5.268)	(4.730)	(5.219)	(4.763)
Corr(CF, Investment)	-	-0.088***	-0.086**	-0.067**	-0.153***	-0.077**	-0.133***
		(-2.588)	(-2.545)	(-1.972)	(-3.779)	(-2.272)	(-3.311)
Tax Convexity	+	0.042***	0.042***	0.045***	0.052***	0.046***	0.052***
		(4.025)	(4.095)	(4.344)	(4.166)	(4.478)	(4.197)
Cash & Cash Equivalent /Total Assets	-	-0.848***	-0.879***	-0.824***	-0.839***	-0.831***	-0.820***
		(-5.245)	(-5.462)	(-5.128)	(-4.141)	(-5.163)	(-4.065)
Log (Total Assets)	+	0.196***	0.196***	0.200***	0.193***	0.191***	0.183***
		(12.208)	(12.168)	(12.421)	(9.913)	(11.928)	(9.418)
Leverage	+	0.006***	0.006***	0.006***	0.007***	0.006***	0.007***
		(3.877)	(4.106)	(3.751)	(3.614)	(4.187)	(3.801)
Market-to-book Ratio	+	0.102***	0.103***	0.110***	0.115***	0.106***	0.115***
		(4.608)	(4.650)	(4.952)	(4.279)	(4.794)	(4.290)
Constant		-3.860***	-3.864***	-3.582***	-3.115***	-3.429***	-3.337***
		(-12.705)	(-12.580)	(-12.213)	(-9.162)	(-11.781)	(-9.730)
Industry Control		Yes	Yes	Yes	Yes	Yes	Yes
Year Control		Yes	Yes	Yes	Yes	Yes	Yes
Number of observations		8,286	8,286	8,286	6,120	8,286	6,120
Pseudo R2		0.237	0.236	0.236	0.251	0.235	0.249

Panel B: Simultaneous Equation Model			
	Hedging Dummy	Bondholder Rights	Stockholder Rights
	coef/t	**coef/t**	**coef/t**
Hedging Dummy		-0.352***	-0.719***
		(-5.373)	(-4.406)
Stockholder Rights (1-GIM/24)	0.664*	0.432***	
	(1.872)	(4.386)	
Bondholder Rights (FBX/15)	0.305***		0.073
	(4.174)		(1.601)
Log (CEO Delta)	-0.002		
	(-0.816)		
Log (CEO Vega)	0.022***		
	(5.343)		
Debt Maturity		-0.000***	
		(-3.297)	
Convertibles		-0.258***	
		(-32.152)	
Volume			2.769
			(0.837)
Delaware Incorporation			0.044***
			(4.540)
Cash & Cash Equivalent /Total Ass	-0.265***	-0.151***	-0.107***
	(-4.928)	(-5.432)	(-2.658)
Log (Total Assets)	0.061***	-0.025***	0.037***
	(12.670)	(-5.804)	(3.505)
Leverage	0.002***	0.003***	0.002***
	(3.090)	(12.656)	(5.010)
Market-to-book Ratio	0.032***	0.011***	0.035***
	(4.298)	(2.850)	(4.932)
Industry Control	Yes	Yes	Yes
Year Control	Yes	Yes	Yes
Number of observations		8,286	
Pseudo R2		n.a.	

Table 2.5: The influence of governance structure on hedging in subsamples

This table reports the baseline multivariate regressions for the subsamples by stockholder rights and by bondholder rights. We control for industry effects by using the Fama-French 48-industry classification and control for time effects by using year dummies. The robust standard errors are used to calculate Z-Statistics that are reported in parentheses below estimates. ∗, ∗∗ and ∗∗∗ denote significance at the 10, 5 and 1 percent level, respectively.

		[1]	[2]	[3]	[4]
		Strong Stockholder Rights (> Median)	**Weak Stockholder Rights (< Median)**	**Strong Bondholder Rights (> Median)**	**Weak Bondholder Rights (< Median)**
Stockholder Rights (1-GIM/24)	+/-	0.611*	0.068	0.995***	-0.017
		(1.669)	(0.175)	(5.014)	(-0.063)
Bondholder Rights (FBX/15)	+/-	0.240**	0.163	0.127	-1.070***
		(2.018)	(1.146)	(0.774)	(-3.243)
Log (CEO Delta)	+	0.033**	0.050***	0.032**	0.049***
		(2.444)	(2.649)	(2.321)	(2.693)
Log (CEO Vega)	-	-0.009	-0.016	-0.016	-0.001
		(-0.571)	(-0.848)	(-0.976)	(-0.081)
Foreign Sales/Total Sales	+	0.551***	0.438***	0.561***	0.385***
		(6.031)	(4.568)	(6.616)	(3.696)
Floating-rate Debt/Total Debt	+	0.374***	0.303***	0.288***	0.340***
		(4.206)	(2.958)	(3.293)	(3.160)
Corr(CF, Investment)	-	-0.155***	0.006	-0.122***	-0.035
		(-3.158)	(0.111)	(-2.869)	(-0.590)
Tax Convexity	+	0.055***	0.046***	0.017	0.093***
		(3.779)	(2.951)	(1.342)	(5.102)
Cash & Cash Equivalent /Total Assets	-	-0.947***	-0.607**	-1.072***	-0.653***
		(-4.528)	(-2.227)	(-4.531)	(-2.835)
Log (Total Assets)	+	0.200***	0.207***	0.156***	0.240***
		(8.962)	(8.301)	(7.116)	(9.176)
Leverage	+	0.005**	0.007***	0.008***	0.001
		(2.518)	(2.899)	(4.231)	(0.498)
Market-to-book Ratio	+	0.104***	0.101***	0.120***	0.072**
		(3.640)	(2.784)	(3.982)	(2.051)
Constant		-3.646***	-3.935***	-3.591***	-3.945***
		(-7.104)	(-9.002)	(-9.377)	(-7.582)
Industry Control		Yes	Yes	Yes	Yes
Year Control		Yes	Yes	Yes	Yes
Number of observations		4,215	4,071	5,377	2,909
Pseudo R2		0.246	0.263	0.249	0.261

CHAPTER 3: DO STRATEGIC ALLIANCES AND JOINT VENTURES CREATE VALUES FOR BONDHOLDERS AND SHAREHOLDERS?

Dell Inc. unveiled an expanded global alliance with Oracle Corp … Marius Haas, president of enterprise solutions for Dell, said the alliance will help Dell "grow fast in the data-center and gain market share across the world in our three core businesses."… Oracle President Mark Hurd said this significantly expanded strategic partnership "is an extension of Oracle's engineered systems strategy where we simplify IT and reduce integration costs by delivering hardware and software together."

----- Wall Street Journal, 2013/06/04

3.1 Introduction

In the past decades, business has been experiencing a wave of organization restructure. The evolution of such remarkable restructuring is not only observed in the equity redistribution of ownership, such as spin-offs, privatization and mergers and acquisitions, but also witnessed through the activity of corporate alliances by way of joint ventures or strategic alliances. The alliance market has been recognized by CEOs as important as the financing and product markets. For example, Chan et al. (1997) document that 63% of the fastest growing U.S. companies participated or planned to participate in an alliance based on a 1995 sample. Anand and Khanna (2000) report more than 20,000 global alliance announcements in 1999 and 2000. A survey implemented by McKinsey Co., also shows that between 1996 and 2001 there were about 57,000 alliances with a total value of $12 trillion dollars. Alliances can be utilized in many forms, from simple contract agreements with no any equity ties to more formal business arrangements with the establishment of an independent new entity which has a feature of equity ownership and shared managerial control. Theoretically, alliances refer to all agreements under which two or more entities combine resources to form mutually advantageous business arrangements to achieve predetermined objectives. In particular, alliances

include joint ventures, strategic alliances, research and development agreements, and sales/marketing agreements. This study focuses on two major types of alliances: joint ventures and strategic alliances. Joint ventures are independent entities whose equities are jointly owned by partnering firms. In strategic alliances, partnering firms agree to pool resources but do not make equity investment or create a new organizational entity. Consequently, strategic alliances are similar to joint ventures, but do not involve equity infusion or the creation of a third entity.

A substantial body of research examines the motivation of corporate alliance and concludes that the rationales can be for non-bureaucratic organizational arrangement, reducing risk in supply chain, shortening the product life cycles, catering capital requirements, and increasing market power.[26] Popularity of corporate alliances in practice and the rationales developed in academia both imply these activities should be associated with significant benefits. In the studies of the effects of alliances on firm value, McConnell and Nantell (1985) first document positive wealth effects of stockholders around joint venture announcements by examining a sample of 136 events from 1972 to 1979. On average, each participant enjoys an abnormal return of 0.74% over a 2-day window. In addition, Johnson and Houston (2000) reexamine the stockholder wealth effects of joint ventures, whereas Chan et al. (1997) investigate those of strategic alliances. Both studies find positive price reactions. Particularly, Johnson and Houston (2000) observe a positive return of 1.67% based on 119 joint ventures from 1991 to 1995. Chan et al. (1997) examine 345 strategic alliances from 1983 to 1992 and find a significant and positive abnormal return of 0.82%.

As summarized above, existing literature examining the effects of alliances on firm value mainly focuses on shareholders' wealth. Recent studies on major corporate events suggest that the announcement effects are not limited to shareholder wealth, but to bondholder wealth (e.g., Billett et al., 2004; Thompson and Apilado, 2009; Baran and King, 2010). In particular, certain events may create benefits for both stockholders and bondholders, leading to an overall increase in firm value. On the other hand, there may be wealth transfers between shareholders and bondholders, resulting in insignificant effects

[26] See Spekman et al. (1998) for a complete survey.

on firm value.[27] Following this line of research, our first research question is to explore how alliances affect bondholders and overall firm value given that shareholders have been found to react positively to these events. The investigation of the wealth effects for all claimholders is critical to the understanding of the documented value creation to shareholders, the yet-explored bondholder reaction, and the overall impact on firm value.

More importantly, our second research question centers on the sources of value creation. In particular, what are the main drivers of claimholder wealth effects associated with alliances? Current studies indicate that corporate alliances create shareholder value via the benefits from synergy, risk diversification, increase in market power, better efficiency in resource allocation, and good corporate governance (Bodnaruk et al., 2013). We conjecture that bondholders should also benefit from these sources of value creation. Furthermore, literature suggests that alliances mitigate agency conflicts between shareholders and bondholders by limiting opportunistic behaviors (Chan et al., 1997; Robinson and Stuart, 2007), reducing managerial incentive problems (Robinson, 2008), or serving as a commitment technology to overcome agency problem (Bodnaruk et al., 2013). Therefore, the potential alleviation of agency conflicts may result in a decrease in the agency cost of debt and a positive impact on bondholder value. By examining the above value sources, we gain valuable insights into the key factors of value creation around alliance events.

In this study, we examine the effects of alliances on value creation to shareholders, bondholders, and the overall firm. We further explore the determinants of the value creation associated with these alliance events. Amici et al. (2013) examine the impacts of joint ventures and strategic alliances on shareholders' value for European and US banks. They find that the value effects differ between joint ventures and strategic alliances. Following Gleason et al. (2003) and Amici et al. (2013) by recognizing the differences

[27] For example, Veld and Veld-Merkoulova (2008) examine the effects spin-offs on wealth creation to both shareholders and bondholders. Thompson and Apilado (2009) study carve-outs and find significant wealth effects for both stocks and bonds. Eberhart and Siddique (2002) provide evidence that in seasoned equity offerings (SEOs) wealth is transferred from shareholders to bondholders because SEOs reduce default risk. Maxwell and Rao (2003) examine the spin-offs and find wealth transfer from the bondholders to the stockholder. Baran and King (2010) also observe wealth transfer effects from bondholders to stockholders in going private transactions. Billett et al. (2004) focus on the effect of mergers and acquisitions on bondholders, but find no merger-induced wealth transfers between bondholders and stockholders.

between these two types of alliances, we examine the wealth effects and perform hypothesis tests for the value creation associated with joint venture and strategic alliance, respectively. The conclusions drawn by Amici et al. (2013) suggest that the determinants of value creation through strategic alliances and joint venture can be different. Therefore, for joint ventures we examine the hypotheses of synergy effect (e.g. McConnell and Nantell, 1985; Johnson and Houston, 2000; Gomes-Casseres et al., 2006), risk-sharing (e.g. Johnson and Houston, 2000), alleviation of financial constraints (e.g. Johnson and Houston, 2000), and organizational flexibility (e.g. Mody, 1993). For strategic alliances, we investigate the synergy effect (Chan, et al. 1997), alleviation of financial constraints (Lerner and Rajan, 2006; Boone and Ivanov, 2012), and organizational flexibility (Bodnaruk et al., 2011; Chan et al., 1997; Mathews and Robinson, 2008).

Based on a sample of 3,243 alliances, we find positive and significant stock and bond price reactions around the alliance announcements, suggesting an increase in stockholder and bondholder wealth. In particular, for the joint venture sample, the average abnormal return over a two-month window is 0.58% for bondholders and 1.02% for shareholders. We find similar results for strategic alliances: the mean abnormal return is 0.72% for bondholders and 1.09% for stockholders over the two-month window.

We further explore the above-mentioned hypotheses that can explain the value creation through corporate alliances by using multivariate regression analyses. Results show that for joint ventures, aggregate synergy effect is a significant driver of value creation to shareholders and entire firm, but not to bondholders. Nevertheless, when we decompose the aggregate synergy effect into financial and operating synergy, interesting results emerge. In particular, joint ventures create value to bondholders through financial synergy effect and to shareholders through operating synergy effect. For synergy effect hypothesis, we further add to the literature by examining financial and operating synergy effects. In addition, alleviation of financial constraints hypothesis holds for shareholder reaction, but does not help explain bondholder wealth effects. We also find that uncertainty about profitability in the alliance industry has a positive and significant effect on bondholder and stockholder value. However, we do not find significant evidence for risk-sharing hypothesis, suggesting that the motivation of sharing risk between/among participants via joint venture is weak. On the other hand, for strategic alliances value

creation from synergy is significant to shareholders, bondholders, and the entire firm. Both financial and operating synergy effects contribute to bondholder wealth, while only operating synergy effect has a significant impact on shareholder value. We find significant effect of organizational flexibility on shareholder wealth, but the effect is modest. With respect to deal characteristics, we find that horizontal or domestic collaboration in strategic alliances generates larger returns for stock, while equal ownership in joint ventures leads to lower bondholder and stockholder returns.

As a robustness check of stockholder return, we employ both the market and Fama and French (1993) three-factor models to estimate and report the abnormal stock returns. The results from the two models are consistent. In addition, as synergy is the dominant value driver of bondholder wealth effect, we explore the link between synergy and bondholder reaction to alliance announcements by convertibility, credit rating, seniority, sinking fund provision and maturity. The results show that financial synergy is a significant driver of bondholder wealth effect for nonconvertible bonds at alliances. This implies that non-convertible bonds in general behave like straight debt, and reap the benefits mainly from financial synergy. On the contrary, operating synergy has a positive and significant effect on convertible bond value, indicating that convertible bondholders react more like stockholders. When performing the analysis by credit rating, we find that financial synergy effect generates value to both groups of bondholders, but the impact is larger for speculative grade debt. For example, for joint ventures a one-percent increase in synergy leads to 0.457% increase in abnormal bond return for speculative grade and 0.156% increase for investment grade. Interestingly, operating synergy is a significant driver of bond value for speculative grade debt in strategic alliances. This seems to imply that speculative grade bonds “behave like” convertible bonds or stocks. Furthermore, the impacts of synergy effect on bondholder wealth are significantly associated with the priority structure of bonds. We show that unsecured or junior/subordinated bonds, bonds without a sinking fund provision, and longer-maturity bonds gain more benefits from synergy. The results of the bond grouping analysis suggest that joint ventures and strategic alliances generate value to bondholders mainly through synergy and the impact of synergy on bond return differ greatly by bond characteristics.

Our study makes the following main contributions to the literature. First, we distinguish between strategic alliances and joint ventures as Gleason et al. (2003) and Amici et al (2013) and perform a comprehensive study of the effects of the two types of corporate alliances on bondholder, shareholder and firm value based on a large sample of alliances from the mid-1980s to present. Given the extant literature on stockholder reaction to alliances, our results provide strong empirical support that alliance is an important corporate strategy that is associated with significant value creation to other claimholders, i.e., bondholders.[28] To the best of our knowledge, our study is the first examining public bondholder reactions to two types of alliances, i.e. strategic alliances and joint ventures. In particular, we find no evidence of wealth transfer between bondholders and shareholders, and there is significant value creation to both claimholders with the size of abnormal returns economically and statistically significant. Second, we develop major hypotheses to explore how the sources of alliance benefits contribute to claimholder wealth effects after controlling for alliance and firm characteristics. Amici et al. (2013) examine how deal characteristics in cross-border banking alliance affect the value creation. Bodnaruk et al. (2013) argue that alliance can work as a commitment vehicle to overcome agency problems and a simultaneous governance mechanism to influences the announcement premium. We find strong support for the synergy effect and the components of synergy (financial and operating) are linked to claimholder wealth effects. We also find support that the positive reactions of stockholder and bondholder can be partially explained by the alleviation of financial constraints and organizational flexibility effect associated with alliances. Finally, our results based on individual bond-level analysis further shed light on the essential role of bond structure on the relation between the synergy benefits and bondholder wealth. We find novel and interesting results on how the relation between synergy and bondholder reaction varies by convertibility, credit rating, and bond priority structures, (namely, seniority, sinking-fund provision, and remaining maturity). Convertible bonds behave more like equity than debt at the alliance announcements. Speculative grade bondholders are more sensitive to the synergy effect. Lastly, bonds with a lower priority structure (e.g., junior/subordinated,

[28] Fang et al. (2012) is a study examining the effects of strategic alliances on a claim other than equity. Different from our study, they focus on cost of bank debt (i.e., bank lenders) and examine strategic alliance activities.

non-sinking-fund, and longer-maturity) have a stronger reaction at alliance announcements to the synergy effect than those with a high priority structure.

The paper is structured as follows. Section 2 reviews the extant literature on the motivations for alliance activities and proposes testable hypotheses to link the relation between the alliance benefits and value creation to shareholders and bondholders. Section 3 describes data sources and variable construction. Section 4 reports the univariate analyses of abnormal bond and stock returns at alliance announcements, the multivariate regression results of abnormal bond, stock and firm returns on various explanatory variables, and extended analyses. Section 5 concludes.

3.2 Literature Review and Hypothesis Development

Coase (1937) argues that the boundary of a firm is positioned in the place where the transaction costs of production within the firm equals to those between firms. In other words, whether the transactions occur by way of intra-firm activities or inter-firm activities depends on the costs associated with fulfilling those transactions.[29] Rigid firm boundary squeezes the scale of economy and impedes resource sharing. Excessive market competition blocks the flow of knowledge and might also impede technology innovation. Information asymmetry and market frictions may lead to inefficient pricing, further discouraging the transactions. In contrast, alliance among the firms can provide the channels to overcome these obstacles. As a result, the optimal firm boundary moves from a wholly-owned organization to a one-off market contract as an outcome of economic benefits and costs between complete integration and purchase/sell. Williamson (1979) suggests that along this organizational spectrum corporate alliance occupies an intermediate point. Unlike mergers and acquisitions, firms involved in an alliance retain their respective identities and independence. In addition, different from the peers in the spot market transactions, alliance partners do not need the marketplace as a bridge to complete a corporate transaction. The theoretical research proposes that firms benefit from alliance activities through the following channels: improvements in efficiency,

[29] We do not claim that the minimization of transaction costs is the only rational behind of alliance activity. Strategic collusion theory or the theory of organizational learning can also be alternative motivations (Kogut, 1988). Based on the principle that economic rationality is viewed fundamental when firms decide the boundary, we use the framework of transaction cost theory to develop testable hypotheses.

pooling of learning and knowledge, risk reduction, access to additional capital, and enhancement of market power.

In this study, we focus on two major forms of alliances, namely joint ventures and strategic alliances. Current literature examines the joint venture and strategic alliance events separately, recognizing the differences in characteristics between these two forms of alliances (e.g. Gleason et al., 2003; Amici et al., 2013). In particular, joint ventures are formed when partners create, with equity infusion, a new business entity specifically devoted to a common product or service. On the other hand, strategic alliance partners pool resources for an agreed-upon collaboration, but do not share equity control or create a new organizational entity. BIS (2001) states that alliance strategies enable firms to cooperate without relinquishing control of their own operations and activities. Chan et al. (1997) indicate that strategic alliances involve two or more firms cooperating as partners in an arrangement through which the firms share resources in production, marketing, distribution or technology, and thereby seek mutual benefits for all participants. This form of partnership contains flexible agreements but does not involve equity infusions. To explore how corporate alliances create value for claimholders, we present the four major benefits of alliances: synergy, risk-sharing, alleviation of financial constraints, and organizational flexibility.

3.2.1 Synergy Effect

The theory of synergy effect argues that collaboration or amalgamation of the firms has greater value than the simple sum of individual firms due to improved efficiency, complementary technology, or increased market power. Empirical research has documented such synergy value associated with mergers and acquisitions (Houston et al., 2001; Mulherin and Boone, 2000; Kaplan and Weisbach, 1992; Lang et al., 1989).[30] By arguing that joint venture is similar to mergers but insulated from management displacement, McConnell and Nantell (1985) interpret the gains observed in a joint venture event as a direct reflection of synergy effect. On average, each participant earns an abnormal return of 0.73% in joint ventures. Johnson and Houston (2000) suggest that operating synergy can be achieved from both horizontal and vertical partnerships. That is,

[30] Although several studies argue that target firms earn a substantial abnormal return than acquirers in mergers and acquisitions, some studies report positive combined returns at the firm level.

horizontal synergy is gained from increased market power and economies of scale, while the collaboration in inventory and distribution systems leads to vertical synergy. Furthermore, synergy results not only from firms' tangible productivity, but also from intangible productivity, e.g., decision-making procedure or knowledge flow. As argued in Chan et al. (1997), strategic alliances optimize the decision-making procedure by granting decision makers with valuable information or skills as a result of collaboration. Gomes-Casseres et al. (2006) argue that the key motivation of alliances is the integration of knowledge flow (e.g., patents) between partnering firms.

Existing empirical research find positive wealth effects for shareholders at alliance events including mergers, joint ventures, and strategic alliances. We argue that the benefits of collaboration, synergy value, should also extend to bondholders. For example, synergy effects from mergers create bondholders' wealth, which are reported in Settle et al. (1984) and Billett et al. (2004). The authors document that bondholders share some of the synergy with shareholders. Merton (1974) proposes that corporate debt can be regarded as a risk-free bond less a put option, which has the firm as the underlying asset and the face value of the debt as the strike price. An increase in firm value leads to a decrease in the value of the put option and therefore an increase in corporate debt value. Graham et al. (2008) argue that high market value of firms provides more claimable assets over book assets to creditors in the case of insolvency. Following the theory of synergy effect, we propose that if alliances create synergy value, both stockholders and bondholders should have positive reactions to the announcements of alliances. In particular, we develop Hypothesis 1 (H1) below:

Hypothesis 1: Synergy effect from joint ventures (strategic alliances) creates value for shareholders and bondholders.

We note that there may be wealth transfer between bondholders and shareholders at the alliance events. Therefore, we further investigate the overall firm wealth effect and the cases in which synergy effect is found in one stakeholder instead of both. Finally, as synergy effect can be decomposed into operating and financial synergy effects, we further test Hypothesis 1 for each component of aggregate synergy effect.

3.2.2 Risk-sharing Effect

Martin (1996) explores a risk-sharing explanation for mergers and acquisitions when firms are more likely to use stock payment to mitigate the riskiness of the target firm. Alliance is also a useful device to reduce risk when the venture is highly uncertain and/or requires substantial up-front investments. A professional survey conducted by CFO Research Services in 2004 indicates that firms are inclined to share business or financial risks via forming alliances (Nicolaou and Christ, 2011). Note since risk-sharing requires uncorrelated cash flows of partnering firms for achieving risk reduction, strategic alliance does not fit under such explanation. Only joint venture partners can claim the residual value based on their equity investments, while participants in strategic alliances share the profits (or losses) from the collaboration based on the agreements.

Johnson and Houston (2000) argue that joint ventures facilitate efficient risk-sharing because the size of the investment per firm is reduced, allowing the partners to expose fewer resources to risk. We propose that bondholders should benefit from the risk-sharing effect because firm risk is reduced as a result of the imperfect correlation between the cash flows of participants. Kim and McConnell (1977) and Lewellen (1971) define such benefit as risk-sharing effect through which uncorrelated earnings reduce the default risk of the partnering firms. On the other side, Galai and Masulis (1976) argue that risk-sharing effect from conglomerate mergers increases bondholder value but decreases shareholder value, resulting in no change in firm value. This is consistent with the contingent claim theory that lowering firm risk leads to a decrease in shareholder value, but an increase in bondholder value. In the spirit of Mansi and Reeb (2002), Shastri (1990), and Billett et al. (2004), we conjecture that for joint ventures the risk-sharing effect should lead to gains to bondholders, but losses to shareholders. We formulate Hypothesis 2 (H2) as follows:

Hypothesis 2: Risk-sharing effect from joint ventures leads to a positive effect on bondholders' wealth, but a negative effect on shareholders' wealth.

3.2.3 Alleviation of Financial Constraints

Financing constraints may arise if there are market frictions, such as information asymmetry, that prevent firms from securing a fair price on external financing sources. Financial theory suggests that financially constrained firms are more likely to forgo

investment opportunities due to the lack of economic resources, resulting in lower firm value. The survey by Campello et al. (2010) indicates that financially constrained firms tend to cut technology spending, employment, and capital spending during crisis conditions. Therefore, firm value can be enhanced when financial constraints are alleviated and valuable investment opportunities are less likely to be passed up as a result. Lerner et al. (2003) use biotechnology firms as a research sample and find as the firms are unable to issue equity, they intend to turn to alliance as a financing tool.

Johnson and Houston (2000) suggest that joint ventures are likely to be formed when partnering firms have financing constraints. By establishing an entity with mutual benefits and resource sharing, and thereby reducing the transaction costs associated with defaults and improving the efficiency of resource allocation, firms can alleviate the negative impact of financial constraints. Consistent with Boone and Ivanov (2012), we propose that the alleviation of financial constraints also applies to strategic alliances because partnering firms share resources and have a lighter burden of raising external financing. This benefit would be most valuable to firms with a high level of financial constraints. In addition, we conjecture that the alleviation of financial constraints is beneficial to bondholders and stockholders because firms can avoid or reduce the need for costly external financing and are less likely to forgo good investment opportunities. Therefore, we formulate Hypothesis 3 (H3) for joint ventures as follows:

Hypothesis 3: The abnormal stock or bond returns of participating firms around joint ventures (strategic alliance) are positively related to the extent of the firms' financial constraints.

3.2.4 Organizational Flexibility

Corporations operate in a dynamic environment with constant changes in customer demand, industry structure, competition, technology, and government policies and regulations. To survive and thrive through the external dynamics, firms must have the ability to adjust their business strategies in a timely and efficient manner. Literature identifies several channels through which alliances increase organizational flexibility. First, firms can tap resources under higher uncertainty especially in cases where high level of information asymmetry exists between buyers and sellers (Kogut, 1991). Second, alliances provide a good opportunity for partnering firms to experiment with the

investment. Finally, there are no demands for hefty up-front investments, no integration costs (Kogut and Singh, 1988), and low termination cost (Balakrishnan and Koza, 1993).

Specifically, Mody (1993) argues that alliances can be utilized by firms as an "experimental" set-up to learn more about the parameters of technology and product market. Chan et al. (1997) suggest that strategic alliance offers the participating firms an intermediary step before they commit further investments. Such organizational flexibility grants the firms a real option that enables them to defer, expand, contract, or even abandon the investments in an efficient way. The value of this real option increases with project uncertainty because the option holders can redirect their investments after more information becomes available. Therefore, we argue that such flexibility is likely to create value, benefiting stockholders and bondholders. Furthermore, organizational flexibility obtained through alliances is particularly valuable to firms with significant demand fluctuation and firms in a market with rapid technological change or significant risk of failure at the developmental stage. Therefore, we expect that alliances with more uncertainty should create a larger value for partnering firms. Although strategic alliance is a more loosely-coupled collaboration than joint venture, joint venture is characterized with unbinding arrangements, small initial capital outlay and low cost of withdrawal. Vernon (1983) regards joint ventures as an approach of protective strategy by which firms hedge against uncertainty, especially in industries with modest business concentration. In this research, we examine if organizational flexibility explains stockholder and bondholder wealth effects around both joint venture and strategic alliance events. We form Hypothesis 4 (H4) as follows:

Hypothesis 4: The abnormal stock and bond returns of participating firms around joint ventures (strategic alliances) are positively related to the volatility of sales, product market competition or uncertainty of investment involved in the partnership.

3.3 Sample Selection and Descriptive Statistics

3.3.1 Sample Selection

We employ multiple databases in this research by starting with Security Data Corporation (SDC), which provides the alliance data most commonly used in empirical studies in this area (Bodnaruk et al., 2013; Boone and Ivanov, 2012; Fang et al., 2012;

Robinson, 2008;). SDC compiles the data from the U.S. Securities and Exchange Commission (SEC) filings, trade publications, wires, and other news sources. Following Lindsey (2008), Gomes-Casseres et al. (2006), and Baker et al. (2002), we identify an alliance as an equity-linked organization (joint venture) or a contract-linked arrangement (strategic alliance). We then require the alliances to have at least one U.S. participating firm. Using CUSIP codes, we retrieve financial information from COMPUSTAT, stock prices from CRSP, and bond pricing data from multiple bond databases. In particular, bond databases include Lehman Brothers Fixed Income (LBFI) database and Mergent's Fixed Investment Securities Database (FISD). For FISD, we combine all transactions of public bonds from the National Association of Insurance Commissioners (NAIC) during the period from 1994 to 2011 and FINRA's Trade Reporting and Compliance Engine (TRACE) from 2002 to 2011. The final sample includes 3,243 announcements of alliances from 1984 to 2011, of which 1,266 and 1,977 announcements are identified as joint ventures and strategic alliances, respectively.

3.3.2 Variable Construction

We construct the following two sets of variables as major drivers to explain the shareholder and bondholder wealth effects at the announcements of strategic alliance and joint venture. The first set of variables is designed to test the above-mentioned hypotheses for the claimholder's wealth effects at alliance events: synergy effect (H1), risk-sharing effect (H2), alleviation of financial constraints (H3), and organizational flexibility (H4). Note that we employ all four hypotheses (H1, H2, H3 and H4) to explain the wealth effects for joint ventures, and hypotheses H1, H3 and H4 to investigate the wealth effects for strategic alliances.

Synergy effect (H1): To construct a measure of synergy, we follow Devos et al. (2009) and Houston et al. (2001) to calculate the present value of incremental capital cash flow (ICCF) since an alliance is typically launched through three years after the alliance.[31] As suggested in the literature, this measure of synergy enables us to capture the benefits of alliance from profit increases and cost savings in operation, investment, and taxes. We calculate this measure as follows:

[31] Chan et al. (1997) report an average 5-year life span for strategic alliance. Our sample has a median (mean) duration of alliance of 3 (4.3) years. Therefore, we adopt 3 years in the synergy calculation.

$$PV_{ICCF} = \sum_{t=1}^{3} \frac{ICCF_t}{(1 + K_t)^t},$$

$ICCF_t$ is the difference between capital cash flow at time t (CCF_t) and time 0 (CCF_0), where time 0 refers to the year of alliance announcement. CCF = EBIT × (1 - T) - (ΔWC - DEP) - CAPEX + (Debt × R × T). From COMPUSTAT, We extract the data of earnings before interest and tax (EBIT), the change of working capital ($\Delta WC = WC_t - WC_{t-1}$), depreciation (DEP), capital expenditure (CAPEX), and long-term debt (DEBT). The effective tax rate (T) is the ratio of total tax expense to pre-tax book income (Armstrong et al., 2012). R is the 10-year constant maturity Treasury bond yield (from the FRED database at the Federal Reserve Bank at St. Louis). To calculate the cost of capital (K_t), we follow Devos et al. (2009) to use 7% as market risk premium and 10-year Treasury bond yield as the risk free rate. We first estimate equity beta based on the 12-month stock returns prior to the alliance, and convert it to assets beta using the Hamada's equation. In addition, we disaggregate total capital cash flow (CCF) into operating capital cash flow (OCCF) and financial capital cash flow (FCCF) to capture the operating and financial synergies respectively. In particular, OCFF = EBIT × (1 - T) - (ΔWC - DEP) – CAPEX, and FCCF = Debt × R × T. Therefore, PV_{ICCF} captures the whole synergy effect, while PV_{IOCCF} and PV_{IFCCF} denote the operating synergy and financial synergy effect, respectively.

Risk-sharing effect (H2): To evaluate the risk-sharing effect, we employ three proxies: industry correlation, change of beta, and a dummy variable indicating business focus. Industry correlation is defined as the correlation between the value-weighted monthly stock return of the participant's industry and that of the alliance industry over the 12-month period prior to alliance announcement. In particular, from CRSP we collect all firms with the same 2-digit SIC code as the participating firms in our alliance sample, and calculate the end-of-month portfolio stock return weighted by the market value of each firm. For the alliance industry, we use the similar procedure by collecting all firms from CSRP with the same 2-digit SIC code as the alliance activity, and compute the end-of-month portfolio stock return weighted by the market value of each firm. To directly gauge the change in the risk of participating firms, we use the change of beta, which measures the change in systematic risk of the participating firm before and after the

announcement. For a given participating firm, we collect the monthly stock prices in the 12-month period preceding the announcement and the 12-month period after to estimate the CAPM betas, and then use Hamada's equation to convert them to asset betas. The dummy variable of business focus takes the value of one when a participating firm has the same 2-digit of SIC code as that of the alliance activity, and zero otherwise.

Alleviation of financial constraints: Following the literature, we adopt the following variables as the proxies for financial constraints: a dummy for low dividend payout (Fazzari et al., 1988), financing deficit (Frank and Goyal, 2003), and K-Z index (Lamont, et al., 2001). Fazzari et al. (1988) suggest that low payout firms do not have sufficient internal capital to fund investments and rely on external sources for financing. Thus, dividend payout can serve as an indicator of financial constraints. We define a dummy variable for low dividend payout to take the value of one if the firm's payout ratio is below the sample median and zero otherwise. The payout ratio is calculated as the ratio of the sum of common dividends and share repurchases to earnings before extraordinary items plus the interest, investment tax credits, and deferred tax credits. Following Frank and Goyal (2003), we define financing deficit as (cash dividends + investments + change in working capital - internal cash flows). All components are scaled by the book value of total assets. A high demand for external financing suggests that a firm's investment needs greatly exceed its internal funds, and hence may indicate a high probability of being financial constrained. While the dividend payout variable mirrors a firm's ability to fund investments using internal funds, and financing deficit reflects a firm's demand for external financing, we employ K-Z index as the third proxy to take into account liquidity based on the gap between external and internal cost of funds. K-Z index summarizes several firm characteristics into a composite measure, reflecting the severity of liquidity constraints. It was first developed by Lamont et al. (2001) based on the results a logistic model estimation in Kaplan and Zingales (1997). Specifically, K-Z ratio = -1.002 × (Cash Flow/Net PPE) + 0.283 × Market to book ratio + 3.139 × (Debt/Total Capital) - 39.368 × (Total Dividend /Net PPE) - 1.315 × (Cash holding /Net PPE). As suggested by Chen and Wang (2012), K-Z index describes the wedge between the external and internal costs of funds. An increase in the wedge indicates that firms face higher costs of external financing than those of internal financing when they need to seek

external financing for their investment needs. Therefore, a firm with a higher value of K-Z index is more financially constrained.

Organizational flexibility effect: To examine the organizational flexibility hypothesis, we construct three volatility measures: the standard deviation of sales growth, the standard deviation of EBITDA, and the standard deviation of R&D expense.[32] Since companies employ alliances to explore a prospective investment, the uncertainty involved in that line of business is a relevant and valuable factor in the decision process. Given the fact that the majority of the alliance entities are not public, each of the volatility measure is estimated on an industry basis. In particular, we first sort all COMPUSTAT firms into industry categories according to their 2-digit SIC codes. EBITDA and R&D are scaled by total assets to control for size. We then calculate the standard deviation of sales growth, EBITDA, and R&D expense for a given industry-year. These three measures are used to proxy for the industry uncertainty at the time of alliance.

In addition to the variables for hypothesis testing, we form the second set of variables based on alliance characteristics. In particular, we employ the number of participants, horizontal vs. vertical, foreign vs. domestic, equal ownership vs. unequal ownership, high-tech vs. non high-tech, and the types of agreements (e.g. licensing, R&D, manufacturing and marketing agreements). First, we conjecture that the number of participants in a given alliance may have an impact on the magnitude of collaboration and market reaction. We next categorize the alliances into horizontal and vertical alliances. Johnson and Houston (2000) examine joint ventures and document a significant difference in abnormal stock return between horizontal (0.65%) and vertical (2.67%) ones. We define horizontal alliances as the cases in which firms from the same industry (based on the 2-digit SIC code) establish a partnership, and the remaining cases are vertical alliances.[33] Foreign alliance is a dummy variable that takes the value of one if at least one partner is a non-US firm, and zero otherwise. Owen and Yawson (2013) suggest

[32] We do not include standard deviation of capital expenditure because of low variation of this measure for most industries.

[33] Note this measure is different from the variable of business focus in the analysis of our second hypothesis because the measure of horizontal/vertical alliance is based on the relation among participating firms.

strong rationales for forming an international alliance: Firms are able to reduce regulatory and/or political risks if they collaborate with local companies in foreign markets. For joint ventures, equal ownership denotes the case in which all participants have an equal share of the alliance. Killing (1983) found that satisfactory performance was more prevalent in ventures with a dominant parent compared to those where control was shared. However, Mantecon et al. (2012) find that the acquisitions made by joint ventures generate larger returns when acquired assets are held by two partners with equal ownership. Note that equity ties apply to joint ventures but not to strategic alliances, thus the equal ownership variable is not applicable to strategic alliances. Considering the fact that high-tech firms are active in alliance activities, we include a dummy to indicate a high-tech alliance if a given alliance involves high-tech industry, and zero otherwise. We follow Carpenter and Petersen (2002) to identify high-tech industries by using the first 3-digit SIC code of 283, 357, 361, 362, 366, 367, 382, 384, 386, and 387. Finally, we consider the types of agreements specified in the alliances. In particular, SDC reports the types of agreements (or activities) involved in alliances, including exploration, funding, licensing, manufacturing, marketing, R&D, and supply.[34] The detailed definitions of variables are provided in Appendix.

3.3.3 Descriptive Statistics

Panel A of Table 1 reports the distribution of 3,243 corporate alliance events from 1984 to 2011. For the full sample, we observe that the number of alliances starts out mildly in the second half of the 1980s, increases sharply in the 1990s, and remains stable in the 2000s. Joint venture and strategic alliance events count for 39% (1,266 out of 3,243) and 61% (1,977 out of 3,243) of the full sample, respectively. The pattern of joint venture activity is different from that of strategic alliance activity. In particular, there is a drop in joint ventures from the 1990s to the 2000s: the number of deals goes from 727 to 393

[34] These classifications are based on flags reported by SDC. Note that a given alliance can be classified into multiple agreements, and some are not classified with any specific agreements.

between the two decades (a 46% drop). For strategic alliance, the trend is the opposite: the number of deals increases from 827 in the 1990s to 1,084 in the 2000s (a 31% increase). The statistical results lend support for examining joint ventures and strategic alliance individually while conducting the analyses of alliance effects.

Panel B presents the deal characteristics of alliances. We find that corporate alliances generally are carried out by two partners as shown by the average number of participants. For the full sample, the number of participants has a mean of 2.23 and a median of 2. In addition, the number of partners involved in joint ventures is slightly higher than that in strategic alliances: the mean value is 2.35 for joint ventures and 2.14 for strategic alliances. Horizontal partnership is less commonly utilized in alliances: 34% in the full sample, 35% in joint ventures and 33% in strategic alliances. In addition, 47% of alliances are engaged with at least one foreign participant, and joint venture is more popular for cross-border collaborations than strategic alliance (60% vs. 39%). For ownership arrangement in joint ventures, equal ownership is prevalent, counting for 71% of the sample. Surprisingly, high-tech alliance only accounts for 30% of the full sample, and 16% and 38% of the joint venture and strategic alliance samples, respectively. We also find that 44% of corporate alliances do not specify the types of agreements or activities in the collaboration. Among those alliances with specific purposes, manufacturing agreements dominates (35%) in joint ventures. For strategic alliances, the types of specific agreements are distributed among the four major classifications: marketing agreements (25%), licensing agreements (19%), R&D agreements (17%), and manufacturing agreements (13%).

3.4 Empirical Results

To explore how joint ventures and strategic alliances affect firm value, we apply the event study methodology to examine the reactions of bond and stock prices around

the announcements. In particular, we examine the abnormal returns of bondholders and stockholders of the participating firms.

3.4.1 Bond and Stock Returns

Following Warga and Welch (1993), we define risk-adjusted abnormal return for a given bond as follows:

$$AR_{bi} = R_{bi} - R_{bm}$$

where AR_{bi} is risk-adjusted abnormal return of bond i, R_{bi} is the raw bond return, and R_{bm} is the return of a bond index matched with bond *i* based on rating and maturity. We estimate R_{bi} according to the following equation

$$R_{bi} = \sqrt[t]{(1+r)^T} - 1$$

where $r = \frac{P_2 - P_1 + I}{P_1}$ is raw bond return calculated from bond prices P_1 and P_2 at dates 1 and 2, respectively; dates 1 and 2 are the first and last trading day on which bond prices are available during a given event window; I is the accrued interest; T refers to the number of days in a given event window; and t is the number of days between dates 1 and 2.[35] Similarly, we calculate the bond index return, R_{bm}, based on the returns of Barclays' Bond Indices reported in Datastream.[36] For a given event-firm, we calculate the weighted average abnormal return using amount outstanding as the weights if the firm has multiple bonds outstanding.

To estimate the abnormal stock returns, three methods are applied. We first estimate the stock excess return as follows:

$$ER_{si} = R_{si} - R_{sm}$$

where ER_{si} is a market index-adjusted excess return for stock *i*, R_{si} is the raw stock return, and R_{sm} is CRSP value weighted index return. ER_{si} is estimated on a monthly basis and

[35] Due to the fact of infrequent daily bond trading, the abnormal bond returns are based on monthly window. As a result, we use the prices of first and last available daily bond transactions in the event window to calculate monthly return *r*. We use all trades for each bond in a given day to calculate these two daily prices as the volume-weighted average price. Bessembinder et al. (2009) argue that volume-weighted average price is a better measure for bond security than the median price or the price in the last trading. Next to find R_{bi} for a specific event window, we apply the compounding rule to the observed monthly return *r*.

[36] These bond indices are categorized into 18 sub-indices based on the combinations of nine bond rating categories (AAA, AA, A, BAA, BA, B, CAA, CA to D, and not rated) and two maturity categories (long-term and intermediate).

summed over a given event window. To consider the risk factors, we next estimate the risk-adjusted abnormal returns using the CAPM market model and Fama and French (1993) three-factor model that have been commonly applied in the event-study literature. The abnormal return is defined as

$$AR_{si} = R_{si} - E(R_{si})$$

where AR_{si} is the risk-adjusted abnormal return for stock i, R_{si} is the raw stock return, and $E(R_{si})$ is the expected return of stock i; $E(R_{si})$ is estimated from the market model/3-factor model. Similarly, AR_{si} is estimated on a monthly basis and summed over a given event window.

Given the fact that valid bond return data and stock return data are required, we arrive at a sample of 3,351 event-firms which are associated with 3,243 overall alliance events, or 1,323 event-firms with joint venture events and 2,028 with strategic alliance events, accordingly.[37] Table 2 reports the abnormal return for bondholders and stockholders of these event-firms. Panel A presents the abnormal bond return for the event month (0, 0), 2-month (-1, 0), and 3-month (-1, 1) windows, respectively. Across all event windows, the mean and median values of abnormal bond return are significantly positive for the full sample, and the joint venture and strategic alliance samples. For example, in the 2-month (-1, 0) window, the abnormal return has a mean of 0.67% in the full sample, 0.58% in the joint venture sample, and 0.72% in the strategic alliance sample. Fang et al. (2012) examine the relation between the activity of product market and cost of bank loan, and find that firms with strategic alliances prior to loan issuance pay a lower cost of bank loan. Our findings of positive bond returns are consistent with their findings. These positive and significant abnormal bond returns suggest that joint ventures and strategic alliances create wealth to bondholders. Interestingly, bondholders enjoy a larger gain from strategic alliances than from joint ventures. Results provide the evidence supporting the necessity to examine alliance effects on bondholder wealth. In addition, this study examining bond reactions contributes to the literature by comprehensively expanding and bridging the gap of the existing research that examines only shareholder wealth.

[37] Due to infrequent bond trading, the sample size for bond abnormal return in 1-month observation window (3,032) is smaller.

Market index-adjusted excess stock returns are reported in Panel B. We find that the excess stock return is consistently significant and positive for the full sample as well as for the joint venture and strategic alliance samples and for the three event windows, (0,0), (-1,0), and (-1,1). For instance, the 2-month (-1, 0) abnormal stock returns are 1.30%, 0.78%, and 1.64% for the full sample, joint ventures, and strategic alliances, respectively. Similarly, we find that stockholders experience a larger gain at the announcements of strategic alliances than at those of joint ventures. Panels C and D report the abnormal stock returns based on CAPM market model and Fama and French (1993) three-factor model, respectively. The results are generally similar to the excess returns in Panel B.[38] In particular, the mean abnormal stock return remains positive and significant across all event windows. For the full sample, the mean value of abnormal return based on market model is 1.09% in the event month (0, 0) and 1.06% in the 2-month window (-1, 0). The abnormal returns based on the Fama and French (1993) three-factor model remain robust. Overall, consistent with previous studies on alliance announcement effects, our findings strongly confirm a positive wealth effect for stockholders.[39] More importantly, we provide new evidence on the gains experienced by bondholders at alliances. Note that the magnitude of abnormal bond return is significant, especially when one considers it relative to the abnormal stock return. For example, the two-month abnormal bond return is about 63% (= 0.67%/1.06%) of the abnormal stock return based on the full sample result. Given sizable gains to the bondholders associated with alliances, we confirm the importance of the examination of bondholder wealth effect in alliance corporate events.

3.4.2 Univariate Analyses

To analyze the sources of gains to bondholders and stockholders at announcements of joint ventures and strategic alliances, we examine the abnormal bond and stock returns by the measures developed in Section 3.2 to test the hypotheses

[38] We estimate the parameters based in the window of (-15, -3) month prior to the event and follow Adams and Mansi (2009) to use CRSP equally weighted index as the market portfolio. The results of using value-weighted CRSP index are similar.

[39] For a 2-day window for joint ventures events, McConnell and Nantell (1985) and Johnson and Houston (2000) find significant cumulative abnormal returns of 0.73% and 1.67%, respectively. Using strategic alliances, Chan et al. (1997) find a significant cumulative abnormal equity return of 0.82% in a 2-day event window.

discussed in Section 2. For brevity, we report the abnormal returns measured over the two-month window (-1, 0). Panel A of Table 3 reports the results for joint ventures. We first examine the abnormal returns by each of the variables pertaining to the hypotheses that help explain the wealth effects.

For the synergy effect, the abnormal stock return of the firms with high synergy is significantly larger than that of the firms with low synergy. The mean difference in abnormal return is 1.29% based on the market model and 1.72% based on three-factor model, both significant at the 5% level. This result suggests that potential synergy through joint ventures helps explain the positive wealth effect for shareholders. On the other hand, abnormal bond return is not significantly different by synergy. We next decompose synergy into operating and financial synergy effects and observe two notable findings. First, bondholders of firms with high financial synergy experience a larger gain than those of firms with low financial synergy. In particular, the average abnormal bond return of firms with high financial synergy is 0.57% higher than that of firms with low financial synergy. Second, stockholders of firms with high operating synergy enjoy a significantly larger gain than those of firms with low operating synergy. The mean (median) difference in the market model abnormal stock return between the high and low operating synergy groups is 0.97% (1.32%).

With regard to the risk-sharing effect, we do not find significant difference in abnormal bond and stock returns by the proxies for this effect. For the three proxies for the alleviation of financial constraints, the comparison shows more prominent results for stockholder than for bondholders. Specifically, the mean difference in abnormal stock return between highly and less financially constrained firms is positive and significant when partitioned by dividend payout, financing deficit, and K-Z index. The results suggest that shareholders of heavily constrained firms gain more than those of less constrained firms. For example, the market model abnormal stock return for firms with a low payout ratio (i.e. highly constrained) is 2.41% higher than that for firms with a high payout ratio. Stockholders in the firms with a higher financing deficit (K-Z index) gain 1.70% (2.31%) larger abnormal return. On the bondholder side, we expect bondholders in firms with a high level of financial constraints to gain significant benefits from alliance events. On the other hand, note that these bondholders are also most sensitive to

uncertainty associated with major corporate decisions. Taken together, the net trade-off impacts from financing constraints on bondholders is an issue of empirical examination. The mixed results shown in the comparisons based on financing deficit and K-Z index are consistent with the trade-off effect. In particular, the difference in abnormal return is positive and significant when the K-Z index is used to partition the sample. The result by financing deficit shows that bondholders gain more from alliances if financing deficit is lower. This result suggests that the concerns for uncertainty for bondholders in firms with significant financing deficit may dominate the benefits associated with alliances. This finding is opposite to our hypothesis of financial constraints and can be possible due to the argument by Chen and Wang (2012) that financially constrained firms are "equity-dependent" firms due to limited access to the credit markets. In terms of the effects of flexibility benefits on joint ventures, we find little difference in abnormal returns between the groups of volatility measures.

We perform the same analyses using the alliance characteristics. Overall, we do not find noticeable differences in bondholder wealth effects between groups based on each of the four deal characteristics. For stockholder wealth effects, we find insignificant differences in abnormal return between horizontal and vertical joint ventures, and between domestic and foreign ones. However, shareholders of joint ventures with equal ownership experience a significantly lower gain than those with dominated ownership, which is consistent with Killing (1983). In addition, we find that high-tech joint ventures are associated with stockholder wealth effects that are significantly lower than non-high-tech ones.

Finally, we examine how abnormal bond and stock returns differ by several main firm characteristics. We use total assets as a proxy for firm size, and market to book ratio as a proxy for growth opportunities. In addition, Mansi and Reeb (2002) argue that bondholders in higher-levered firms enjoy more gains from "risk-sharing" than those in lower-levered ones. Shastri (1990) and Billett et al. (2004) predict more gains in mergers and acquisitions for bonds with a lower rating. Thus, we also include leverage ratio and bond rating. The mean (median) difference in abnormal bond return between large and small firms is -0.33% (-0.10%), which is significant at the 10% (5%) level. We also find that firms with high leverage have a larger stockholder wealth effect and firms with lower

market to book ratio have a larger stockholder wealth effect. The same does not hold for bondholders.

Panels B of Table 3 reports the results for strategic alliances. We find that on average stockholders gain more when strategic alliance generates higher aggregate synergy effect. The mean (median) difference in market model abnormal stock return between the high and low operating synergy groups is 4.41% (2.18%). Notably, both subgroups in either operating synergy or financial synergy show positive stock returns, while the impact on abnormal returns from operating synergy shows a pattern opposite of that from financial synergy. In particular, shareholders from the group of higher operating synergy gain more than the group of lower operating synergy. On the other hand, the group of smaller financial synergy shows higher stock returns than the group of larger financial synergy. With respect to the alleviation of financial constraints through strategic alliance, we find support for stockholder wealth effects based on the 3-factor model. In particular, stockholders gain more if firms have low dividend payout, high financing deficit or high K-Z index. Lastly, the groups by organizational flexibility proxies yield mostly insignificant results.

For deal characteristics, we find that stockholders benefit more from horizontal than vertical alliances, but the alliances across the border generate less value than domestic alliances. These findings are consistent with Chan et al. (1997). For example, the difference in the market model (3-factor model) abnormal stock return between horizontal and vertical strategic alliances has a mean of 2.46% (1.98%), while the corresponding difference between foreign and domestic strategic alliances has a mean of -1.39% (-1.54%). Finally, the results by firm characteristics are mostly similar to those for joint ventures. In line with Chan et al. (1997), smaller firms have greater abnormal bond and stock returns than larger ones. Higher-levered firms and firms with a low market-to-book ratio have larger stockholder wealth effects. Additionally, the comparison based on credit rating shows that strategic alliance activity is more valuable to speculative grade firms than investment grade ones.

In sum, we find that joint ventures and strategic alliances create significant wealth effects for bondholders and stockholders. Abnormal bond return has an average of 0.58% for joint ventures and 0.72% for strategic alliances. Stockholders enjoy a mean abnormal

return of 1.02% for joint venture and 1.09% for strategic alliance based on the market model. When examining the sources for these wealth effects, specifically the financial synergy and operating synergy components of aggregate synergy effects, we observe for joint ventures, financial synergy helps explain bondholder reaction, whereas operating synergy effect is a driver for stockholder wealth effect. For strategic alliances, we find no discernible difference in abnormal bond returns by synergy. However, higher operating synergy leads to larger abnormal stuck returns, whereas more financial synergy is associated with lower returns. These results also suggest the importance of distinguishing between joint venture and strategic alliance samples and decomposing the synergy effect into operating and financial synergy effects. Furthermore, we find solid evidence to support that the alleviation of financial constraints is an important factor for bondholder and shareholder reactions at joint venture announcements, and for stockholders at strategic alliance announcements. For deal characteristics, equal ownership and high tech lead to lower stockholder return for joint ventures, while horizontal and domestic strategic alliances enjoy more favorable stockholder reaction.

3.4.3 Multivariate Regressions

In this section, we investigate the determinants of announcement returns of bondholders, stockholders, and firm for joint ventures and strategic alliances in a multivariate framework. Abnormal firm return is defined as the weighted average of abnormal bond return and abnormal stock return by using debt and equity ratios as the weights. We conduct the analyses based on the joint venture and strategic alliance samples individually to test the corresponding hypotheses discussed in Section 2. In the regression model, we first include the two sets of explanatory variables defined in Section 3.2, namely the variables developed for hypothesis testing and those related to alliance characteristics. Recall for synergy effect, we consider the overall synergy, operating synergy, and financial synergy effects. For the risk-sharing effect, three proxies are used: industry correlation, change of beta, and business focus. We include the low dividend payout dummy, financing deficit, and K-Z index for the alleviation of financial constraints hypothesis. For the organizational flexibility effect, the volatility of sales growth, volatility of EBITDA/TA, and volatility of R&D/TA are considered. The set of

alliance characteristics consists of the number of participants, and dummies for horizontal alliance, foreign alliance, equal ownership, and high-tech.

As the third set of variables, we include control variables consisting of relevant firm characteristics, bond features, and market systematic factors. For firm characteristics, we control for firm size, leverage and market to book ratio. As to bond characteristics, we include bond size, speculative rating dummy, coupon, and time to maturity. We use Moody's ratings on individual bonds and follow Klock et al. (2005) to convert each rating to a numerical rating. In particular, Aaa rating is converted to a value of 22, Aa1 rating to 21, ..., and D rating to 1. For bond size, we sum the amount outstanding of all bonds for a given participant. For coupon and time to maturity, we calculate the firm-level value by using the amount outstanding of individual bonds. For example, coupon rate at the firm level equals the average of coupon rates on individual bonds weighted by the amounts outstanding. Lastly, we consider stock and bond systematic risk factors including the Fama and French's (1993) three factors, market credit premium, interest rate level, and slope. The variable definitions are summarized in the Appendix.

Table 4 presents the descriptive statistics of the variables. All variables are measured in the fiscal year prior to the announcement of alliance events. The reported statistics further confirm the necessity of examining joint venture and strategic alliance events separately. Based on the 1,323 event-firm observations for joint venture and 2,028 event-firm observations for strategic alliance, we note that strategic alliances create larger synergy value than joint ventures: the mean (median) synergy value is $271.19M ($74.52M) for strategic alliances and $216.28M ($60.53M) for joint ventures. When the synergy value is scaled by total assets, we find that overall synergy contributes to an incremental value of 2.1% in strategic alliances, and an incremental value of 1.08% in joint ventures. Operating synergy dominates financial synergy in size by absolute dollar amount and relative ratio to total assets. We note that firms in strategic alliances benefit more from operating synergy than the firms in joint ventures. On the other side, joint ventures generate a moderately larger financial synergy than strategic alliances. The dollar amount (ratio) of financial synergy is $21.33M (0.19%) for joint ventures and $20.55M (0.15%) for strategic alliances.

We then present the variables related to the risk-sharing effect for joint ventures. The industry-level correlation between the participating firm and the entity of joint venture is high with a mean (median) of 73.86% (88.74%). This high correlation indicates the close association of businesses between the joint venture entity and the parent firms. Our finding also indicates that participating firms experience an average increase of 0.23 in beta. In addition, the mean value of the business focus dummy suggests that 55% of the participating firms are in the same industry as the joint venture. For the measures of financial constraints, we find that slightly more firms in joint venture are categorized as low-dividend payers than those in strategic alliances. Compared to firms in strategic alliances, firms in joint ventures have a higher K-Z index, suggesting that financial constraints may be a greater concern for firms involved in joint ventures. Furthermore, the three measure of organizational flexibility are higher for strategic alliances than for joint venture. For example, on average the industries associated with strategic alliances have a sales growth volatility of 13% and an EBITDA volatility of 1.76%, while those with joint venture activity have a sales growth volatility of 8.13% and an EBITDA volatility of 1.01%. Finally, firms involved in strategic alliances have a smaller firm size, a lower leverage and a higher market to book ratio than firms in joint ventures. As to bond characteristics, firms in strategic alliances tend to issue more speculative grade and shorter maturity debt. The industry distribution of participating firms in joint venture and strategic alliance is provided in Appendix.

Regression results of abnormal bond, stock, and firm returns at joint venture announcements are presented in Panel A of Table 5.[40] For brevity, we report the results based on the 2-month (-1, 0) window and find similar results based on the other windows. We employ two models for each abnormal return: Model 1 examines the overall synergy effect, and Model 2 examines the operating and financial synergy effects separately. From Model 1 of bond return column, we do not find a significant relation between the overall synergy effect and abnormal bond return. However, as we decompose the synergy

[40] In all regression models reported in Table 5, we control for time, industry, and clustering effects. In addition, all models are heterogeneity adjusted and robust standard errors are estimated. In addition, we run (unreported) regressions in which agreement type dummies are included, regressions in which each hypothesis is tested individually, regressions in which we use one variable (instead of multiple variables) to test each hypothesis, and regressions without clustering effects. Our results remain robust across the above-mentioned models. These results are available upon request.

effect into operating and financial synergy effects in Model 2, the coefficient on financial synergy effect is positive and significant at the 10% level. For a one percent increase in financial synergy, bondholders gain 34.2 basis points in abnormal return at the announcements of joint ventures. This suggests that financial strategy is an important driver of bondholder wealth effect in joint ventures. More interestingly, for abnormal stock return, we observe a significant and positive coefficient on operating synergy effect, but an insignificant coefficient on financial synergy effect. The coefficient on operating synergy is 0.075 (significant at the 1% level) based on the market model, and 0.094 (significant at the 1% level) based on the three-factor model. The result indicates that stockholders benefit from synergy mainly through the improvements in operating cash flows and performance, whereas bondholders benefit from synergy through financial cash flows.

The last two columns show the results for firm wealth effects. Abnormal firm return is the weighted average of abnormal bond return and market model abnormal stock return using debt and equity ratios as weights. We find that the overall synergy and operating synergy effects are significant and positive, while the financial synergy effect is insignificant. This result coincides with the findings for stockholder wealth effects and suggests no wealth transfer from bondholders to equity holders. In addition, the findings suggest that the synergy effect hypothesis is well supported in joint ventures and can benefit not only stockholders (Johnson and Houston, 2000), but also bondholders as well as the entire firm. Our analysis of bondholder and firm wealth effects adds to the literature on shareholder returns. Furthermore, operating synergy, not financial synergy, is a significant driver of the firm and stock abnormal returns. On the other hand, bondholder wealth effect is driven by financial synergy rather than operating synergy.

As to the risk-sharing hypothesis, we find little or no support for its explanatory power for the stockholder and bondholder wealth effects. Although industry correlation, change of beta, and business focus have positive impacts on bondholder return, none of them are significant. Similarly, these measures have minimal effect on stockholder and firm returns. These results suggest that risk-sharing may not be a strong motivation for partnering firms in joint ventures. For the alleviation of financial constraints hypothesis, the results on the three proxies suggest evidence supporting this hypothesis. Firms with

low dividend payout have larger abnormal stock returns than those with high payout. As shown in market model of stockholder returns, the coefficient on the low dividend payout dummy is positive and significant at the 5% level. Based on Model 1 in market model, we find that stockholders in the low dividend payout firms experience 1.823% more gain at announcements than those in the high payment firms. In addition, K-Z index in three-factor model and financing deficit measure in both market and 3-factor models have significant and positive coefficients, implying that easing financing constraints through joint venture leads to favorable reaction from stockholders. The same findings hold for abnormal firm returns, but not for bond returns, which also suggest no wealth transfer from bondholders to shareholders.

Additionally, we find evidence to support the organizational flexibility hypothesis. In particular, EBITDA volatility has a positive and significant effect on bond, stock, and firm abnormal returns, with all coefficients significant at the 5% level or better. For example, Model 2 results suggest that one percent increase in EBITDA volatility of alliance industry leads to 0.15% increase in bond value and 0.66% in equity value. As to the alliance characteristics, we find that equal ownership has a significant and negative impact on abnormal returns of shareholders, bondholders, and the entire firm. This result is consistent with Killing (1983), but inconsistent with Slovin et al. (2007). Among the control variables, we find bondholder value is negatively related to time to maturity and interest rate, while market to book ratio has a negative effect on stockholder reaction.

Panel B reports the results for strategic alliances. Similar to the results for joint ventures, synergy effect has significant explanatory power for abnormal stockholder and firm returns in strategic alliances. For instance, one percent increase in synergy effect leads to an increase of 0.176% in market model abnormal stock return (0.176%*15290.22 million (market value of equity for SA sample)=26.91 million, and an increase 0.137% in abnormal firm return. While bondholders receive no significant benefits from aggregate synergy effects from joint ventures as shown in Panel A, they gain significant and positive returns through strategic alliance events. In particular, bondholders gain an additional abnormal return of 2.4 basis points (0.024%*1313=0.32 million) for one percent increase in synergy. More importantly, both operating and financial synergies have a significant and positive effect on bondholder return, indicating that strategic

alliances create value for bondholders not only from an increase in financial flows, but also from operational improvements. Note that financial synergy is an important source for bondholder wealth effect in alliance activities, regardless of the form of the collaboration (joint venture or strategic alliance). Consistent with the results for joint ventures, stockholder and firm wealth effects are driven mainly by operating synergy rather than financial synergy.

We find little evidence to support the alleviation of financial constraints hypothesis in strategic alliances, whereas the joint ventures sample shows significant support for this hypothesis. Regarding the organizational flexibility hypothesis, our results indicate that the product market uncertainty, measured by the volatility of sales growth, has a significant and positive effect on stock returns. For example, Model 2 results show a coefficient of 0.043 based on the market model and 0.062 based on the three-factor model. However, we find little support for bondholder and firm returns. This evidence suggests that benefits from flexibility via strategic alliances may not be substantial.

For alliance characteristics, horizontal alliance has a strong and positive influence on stockholder and firm wealth effects. Compared to vertical alliance, horizontal alliance leads to an additional stockholder gain that ranges from 2.72% to 2.79%. The possible explanations are that firms in horizontal alliance collaborate with partners in the same industry, which makes it more efficient to transfer and share technical knowledge (Chan et al., 1997), or maintain market power in the product market (Kogut, 1988). In addition, foreign alliances are associated with lower abnormal stock and firm returns than domestic ones. This result is consistent with Amici et al. (2013), which suggest that cross-border strategic alliances tend to affect shareholder value in an adverse manner. The effects of control variables are generally consistent with expectations. Stockholders in small firms gain higher return than large firms. Market-to-book ratio shows a negative relation with abnormal stock and firm returns.

To conclude, our findings strongly support the synergy effect hypothesis (H1) that synergy has a significant impact on bondholder and shareholder wealth in joint ventures and strategic alliances. In addition, the components of aggregate synergy show their respective and significant influences on bondholders and shareholders. More specifically,

operating synergy, not financial synergy, is the main driver of stockholder and firm returns in both forms of alliances. On the other hand, bondholder wealth effect in joint ventures is driven by financial synergy, not operating synergy. Bondholders in strategic alliances react positively when there is operating or financial synergy. We find no support for the risk-sharing hypothesis (H2) for either claimholders in joint ventures. These findings have the following interesting and valuable implications. Classic theory formulates that firm value is the present value of future cash flows. Therefore, the impacts of alliance on firm value can be from: the impact on the cash flow stream and/or the impact on the risk (the corresponding cost of capital) by which future cash flows are discounted. Synergy effect captures the impact on the cash flow stream, whereas risk-sharing reflects the effect on risk. The strong evidence supporting the synergy effect and the lack of support for the risk-sharing hypothesis suggest that claimholders are most sensitive to the potential impacts on cash flows associated with the alliances. We find solid evidence for the alleviation of financial constraints hypothesis (H3) for stockholders in joint ventures, but not in strategic alliances. No significant relations are found between bondholder wealth effect and financial constraints in joint ventures and strategic alliances. Lastly, the organizational flexibility hypothesis (H4) receives some support in both samples. The uncertainty about profitability in the alliance industry is a significant factor of bondholder and stockholder wealth effects in joint ventures. In strategic alliances, the uncertainty about the product market matters for stockholder return. Finally, equal ownership in joint venture leads to losses to stockholders. Horizontal or domestic strategic alliances create value for stockholders.

Moreover, our findings contribute to the existing literature by providing evidence confirming that it is essential to examine bondholder wealth effects as well as firm value in study of corporate alliances and to separate the alliances into joint ventures and strategic alliances. The results expand the findings of positive equity returns in the existing literature and demonstrate that such positive wealth effects to equity holders are not at the expense of bondholders through wealth transfer.

3.4.4 Extended Analyses

As shown in previous sections, synergy effects are main factors driving bondholder wealth. Operating synergy creates firm value from the increase in operating

income or the reduction of cost, and financial synergy benefits the firm by means of increasing debt capacity and consequently generating tax credit from the deduction of interest payment. Classical bond pricing theory demonstrates that bond value is positively associated with total firm value (Merton, 1974). Therefore, synergistic gains enhance shareholder as well as bondholder wealth. Based on the fact that a given firm can issue multiple bonds with different characteristics and/or provisions, we conjecture that bondholder reaction to synergy effect may vary by the major features of bonds. To highlight the significant relation between bondholder returns and synergy effects in alliance events and to examine how this relation varies by specific bond characteristics, we conduct an extended analysis on an individual-bond basis.[41] Merton (1974) argues that the value of corporate bond is determined by the risk-free rate, the probability of default, and bond provisions and covenants. In particular, we examine the following five bond characteristics: convertibility, credit rating, seniority, sinking fund provision, and maturity.

First, we examine the convertibility option embedded in bonds. Convertibility offers the bondholders the right to convert their bonds into common stock. As a hybrid instrument, convertible bonds grant investors an upside potential to claim the residual firm value. Davis et al.(1978) examine the reaction of convertible and nonconvertible bonds to earnings announcements and find that the response of convertible bonds' prices to earnings announcements is similar to that of stock prices. As we observe significant differences in how synergy affects the abnormal stock and bond returns, it is interesting to examine if the impact of synergy on bondholder returns differ by convertibility. We conjecture that convertible bonds behave more like equity as an increase in firm value induces convertible bondholders to convert.

We present the bond-level analysis by convertibility in Table 6. Particularly, we run the bond-level OLS regressions for convertible and nonconvertible bonds separately. For each regression, we employ the measures of synergy effect and control variables including deal, firm, bond characteristics and systematic risk factors as specified in the baseline model. Panel A and Panel B present the regression results for joint venture

[41] The above univariate and multivariate analyses employ the firm-level bond return, which is most appropriate when examining the overall bondholder wealth effect.

sample and strategic alliance sample, respectively. For joint ventures, we find a distinct difference in the results for convertible and nonconvertible bonds: convertible bondholders react favorably to operating synergy, whereas financial synergy is a primary driver for the return on nonconvertible bonds. In particular, convertible bond shows a positive coefficient (0.067) of operating synergy (significant at the 10% level), but an insignificant impact of financial synergy. In contrast, we find a positive and strong correlation (significant at the 1% level) between financial synergy and bondholder wealth, however operating synergy shows muted influence on bondholder wealth. We observe the same pattern between convertible bonds and non-convertible bonds using the strategic alliances. With a one-percent increase in operating synergy, convertible bondholder wealth rises by 4.9 basis points. (0.049%*1313=0.64 million) On the other hand, nonconvertible bond returns go up by 13 basis points for a one-percent increase in financial synergy. (Economic significance calculations here may be also needed. 0.13%*1313=1.71 million) Taken together, the results suggest that synergy effect from operating improvements helps explain the wealth effect for convertible bonds, whereas financial synergy is an important driver for the return on nonconvertible bonds. Given that convertible bonds are a hybrid of debt and equity, these findings are intuitive and it is reasonable for convertible bondholders to share the same motivation as stockholders. Meanwhile, nonconvertible bonds should reflect the motivation of straight debt.

The second bond characteristics explored in this section is credit rating. As an important measure of credit quality, bond rating has been comprehensively documented to affect bond value. Hand et al. (1992) report nonzero excess bond returns that are associated with the addition of S&P ratings. Kliger and Sarig (2000) document that the bond rating delivers material information in pricing for both stock and bond securities. Synergy effect improves firm performance and creates extra value, reducing the probability of financial distress. Elliott et al. (2009) find that non-investment grade bonds gains significantly value around SEO announcements while investment grade bonds do not exhibit any significant abnormal returns. They attribute their finding to the effect of reduction in the probability of financial distress as a result of a leverage decrease associated with SEOs. They argue that the marginal impact of the drop in leverage have the greatest impact on lower rated bonds as these bonds should benefit more from

potential reduction in the probability of financial distress. Following their argument, we conjecture that lower rated bonds stand to benefit more from synergy effect, while higher rated bonds gain less from the same effect.

Panel A of Table 7 presents the results of the bond-level regressions for joint venture by credit rating. Financial synergy effect generates value for both groups of bondholders, but the impact is larger for speculative grade bonds. Specifically, a one-percent increase in financial synergy leads to 45.7 basis points (significant at 1% level) increase in abnormal return for speculative grade and 15.6 basis points (significant at 5% level) increase for investment grade. As reported in Panel B for strategic alliances, in line of our predication speculative grade bonds show a significant correlation between operating synergy and bond value, while there is no significant result on the side of investment grade bonds. These findings are consistent with the literature in which speculative grade bonds are documented to have stronger reaction to major corporate events or changes in corporate polices than investment grade bonds. In addition to the aforementioned studies, Elliott et al (2009), Baran and King (2010) find during buyouts speculative grade bonds experience larger losses than investment grade bonds. Billett et al. (2004) document that during mergers target bonds with non-investment grade gain more than those with investment grade, while acquirer bonds with non-investment grade experience larger loss than those with investment grade. By examining how credit rating affects the association between synergy effect and bondholder wealth, our analysis provides additional evidence to this line of literature.

Aside from credit risk, bondholders also face the priority risk of cash flows that are distributed among tranches in case of bankruptcy. Hackbarth and Mauer (2012) document that priority structure plays an important role in determining the value of debt and equity. In particular, priority structure can be characterized by seniority, sinking-fund provision, and maturity. For example, creditors of senior or secured bonds are more protected based on the me-first covenant. Additionally, sinking fund provision affects the distribution of cash flows to bondholders. This provision requires the issuer to perform partial redemption or set aside cash to guarantee future payments. As a result, value of sinking fund bond is less sensitive to the change in firm performance and/or credit risk than that without such provision. Lastly, Billett et al. (2004) and Shastri (1990)

investigate the seniority effects of bond maturity on bond value. They suggest that short maturity bonds are effectively senior to long maturity bonds. Consequently, long maturity bonds are expected to be more sensitive to the effects derived from alliance events than short maturity bonds. Based on the above literature, we conjecture that bonds with weak priority structure (e.g., non-senior, non-sinking-fund, or long maturity bonds) are more sensitive to synergy effect than those with strong priority structure (e.g., senior, sinking fund, and short maturity bonds). In the following analyses, we examine how the characteristics of the priority structure affect the relation between synergy and abnormal bond returns.

Following Hackbarth and Mauer (2012), we employ seniority, sinking-fund provision and remaining maturity as the proxies for the priority structure. In particular, we stratify the sample by senior vs. non-senior bonds, sinking fund vs. non-sinking-fund bonds, and short maturity vs. long maturity bonds. Empirical results are presented in Table 8 through Table 10. Panels A and B of Table 8 present the regression results by seniority for joint ventures and strategic alliances, respectively. Senior bonds include bonds denoted as senior or secured.[42] Non-senior bonds include junior bonds, junior subordinated bonds, subordinated bonds, senior subordinated bonds, and debentures with no senior specification. In the joint venture sample, we find a significant effect of financial synergy on non-senior bonds but insignificant effect on senior bond. For strategic alliances, both senior and non-senior bonds show significant and positive reaction to operating synergy. In addition, the larger coefficients of operating synergy confirm that non-senior bonds benefit more from the synergy effect associated with strategic alliances than senior bonds.

The results of grouping by sinking fund provision are reported in Table 9. For both joint ventures and strategic alliances, we find results supporting our conjecture that weak priority bonds represented by non-sinking-fund bonds are more sensitive to synergy effect. In particular, non-sinking fund bondholders in joint ventures gain 20.6 basis points of abnormal return for a one-percent increase in financial synergy. In contrast, sinking fund bonds do not react significantly to synergy effects. We find similar results for strategic alliances.

[42] Results are similar when we exclude the secured bonds from the analysis.

Finally, we consider priority effects by examining how bond maturity affects the relation between synergy effects and abnormal bond returns. Maturity groups are structured in two ways. First, we use 3 years as the cut-off point to classify bonds with remaining maturity greater than 3 years as long maturity and the remaining as short maturity. Second, we use the median remaining maturity of all bonds in the sample to classify the above-median group as long maturity and the remaining as short maturity. Panels A and B of Table 10 present the results by maturity groups based on the three-year cut-off point for joint ventures and strategic alliances samples, respectively. We observe a significant effect of synergy only in long-term bonds for joint ventures and strategic alliances. Particularly, results from Panel A suggest that financial synergy is significantly and positively associated with the returns of long maturity bonds, but has insignificant impact on those of short maturity bonds. More remarkably, both operating synergy and financial synergy show significant influences on long maturity bond returns, but not on short maturity bond returns. For robustness check, we perform the analysis by maturity groups based on median maturity and report the results in Panels C and D. The findings are generally similar and confirm that long maturity bonds react more significantly to synergy effects than short maturity bonds.

In sum, we examine how the relation between synergy effects and abnormal bond returns varies by a set of bond characteristics. We find that convertible bonds exhibit equity-like characteristics by showing significant and positive return reactions to operating synergy (rather than financial strategy) in joint ventures and strategic alliances. We also find that credit risk has a significant impact on bondholder reaction to potential synergy effects. Speculative grade bonds are more sensitive to the synergy benefits generated in alliances than investment grade bonds. Finally, we find that the impacts of synergy effect on bond value are more prominent for the bonds with weak priority structure. This finding suggests that priority structure of bonds has an important influence on how bondholders gauge the synergistic benefits associated with corporate alliances.

3.5 Conclusions

In this paper, we examine the impacts of corporate alliance events on firm value based on a large sample of 3,243 joint ventures and strategic alliances from 1984 to 2011. We find positive market reactions around the announcements for bondholders and

stockholders. In a 2-month announcement window, the mean abnormal return is 0.67% for bondholders and 1.06% for stockholders. Both types of alliances create value, however, bondholders and stockholders in strategic alliances enjoy larger gains than those in joint ventures.

We further investigate the connection between the benefits of alliance and bondholder and stockholder wealth effects. Based on prior literature, we develop testable hypotheses to explain such connection. Our univariate and multivariate tests show that joint venture and strategic alliance create value mainly through the synergy effect. In both forms of alliances, operating synergy has a significant impact on stockholder wealth and financial synergy is a main driver of bondholder wealth. It is important to note that operating strategy is a more prominent driver of abnormal bond return than financial synergy in strategic alliances. We also find solid support for the alleviation of financial constraints for joint ventures. Moreover, uncertainty about profitability and product market has significant impacts on stockholder and bondholder wealth effects, which is consistent with the organizational flexibility hypothesis. On the other hand, we find little support for the risk-sharing hypothesis. Finally, equal ownership leads to lower bond and stock returns in joint ventures. Horizontal or domestic collaboration among partners in strategic alliances generates positive stockholder reaction.

We extend the analysis on bondholder wealth effect to consider five bond characteristics: convertibility, credit rating, seniority, sinking fund provision and remaining maturity. On an individual-bond basis, we find that convertible bonds behave more like equity, gaining value from operating synergy rather than financial strategy. Financial synergy is a main driver of return on nonconvertible bonds, which is consistent with the bondholder wealth effect observed for bondholders in general. In addition, the impact of synergy on bond value differs by credit rating: Speculative grade bonds gains more value from synergy than investment grade bonds. Moreover, the impacts of synergy on bondholder wealth are associated with the priority structure of bond contracts: The value of bonds with weak priority structure is more sensitive to the synergy effects associated with corporate alliances. In particular, non-senior, non-sinking fund, or long maturity bonds react more significantly to the potential synergistic benefit than senior, sinking fund, and short-term bonds.

To our knowledge, this paper is the first study to jointly examine the impacts of alliances on bondholder and stockholder value. Our findings further contribute to the literature on the important link between business alliances and firm value by exploring which sources of the alliance benefits are main contributors of the wealth effects. Our results provide strong empirical support that alliance is an important corporate strategy that leads to a significant increase in bondholder and stockholder value.

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Table 3.1: Descriptive statistics of alliance activity

This table shows an overview of 3,243 announcements of the alliance from SDC database in the period of 1984 through 2011. We require valid firm financial data from COMPUSTAT, stock price data from CRSP, and bond transaction data from Lehman Brothers' fixed income database, NAIC and TRACE of Mergent FISD database. Based on the presence of a new legal entity and equity ties as a result of the alliance activity, we separate our full sample into two subsamples: joint ventures and strategic alliances. Panel A reports the number and percentage of alliances by year for the full sample of alliance, and also for both joint venture and strategic alliance subsamples. Panel B shows the deal characteristics for full sample of alliance, and for joint venture and strategic alliance subsamples respectively.

Panel A: Distribution of Alliances by Year						
	Full Sample		Joint Venture		Strategic Alliance	
Year	N	%	N	%	N	%
1984-1989	212	6.5%	146	11.5%	66	3.3%
1990-1999	1,554	47.9%	727	57.4%	827	41.8%
2000-2011	1,477	45.5%	393	31.0%	1,084	54.8%
Total	3,243	100.0%	1,266	100.0%	1,977	100.0%

Panel B: Characteristics of Alliances									
	Full Sample			Joint Venture			Strategic Alliance		
	N	Mean	Median	N	Mean	Median	N	Mean	Median
Number of Participants	3,243	2.23	2.00	1,266	2.35	2.00	1,977	2.14	2.00
Deal Characteristics									
Horizontal Alliance (Dum)	3,243	0.34	0.00	1,266	0.35	0.00	1,977	0.33	0.00
Foreign Alliance (Dum)	3,243	0.47	0.00	1,266	0.60	1.00	1,977	0.39	0.00
Equal Ownership (Dum)		n/a		1,266	0.71	1.00		n/a	
High-tech Alliance (Dum)	3,243	0.30	0.00	1,266	0.16	0.00	1,977	0.38	0.00
Types of agreements									
Non-specific Agreement	3,243	0.44	0.00	1,266	0.47	0.00	1,977	0.42	0.00
Exploration Agreement	3,243	0.03	0.00	1,266	0.06	0.00	1,977	0.01	0.00
Funding Agreement	3,243	0.01	0.00	1,266	0.00	0.00	1,977	0.01	0.00
Licensing Agreement	3,243	0.12	0.00	1,266	0.01	0.00	1,977	0.19	0.00
Manufacturing Agreement	3,243	0.21	0.00	1,266	0.35	0.00	1,977	0.13	0.00
Marketing Agreement	3,243	0.22	0.00	1,266	0.17	0.00	1,977	0.25	0.00
R&D Agreement	3,243	0.13	0.00	1,266	0.06	0.00	1,977	0.17	0.00
Supply Agreement	3,243	0.02	0.00	1,266	0.02	0.00	1,977	0.03	0.00

Table 3.2: Abnormal returns for bondholders and stockholders at alliance event

This table shows the mean and median values of abnormal returns around the announcement of alliances for 3,351 participating firms in the full sample, 1,323 in joint venture subsample and 2,028 in strategic alliance subsample, respectively. Panel A describes bond abnormal returns by following Warga and Welch (1993) methodology. We calculate the risk-adjusted abnormal return for a given bond as the raw bond return minus the return of Barclays' bond index which is matched with rating and maturity. Panel B shows the monthly excess returns for stockholders by using excess returns, which are computed as the stock's monthly return minus the monthly value-weighted return of CRSP market index. Panel C and Panel D report stock abnormal returns in the spirit of event study methodology from Brown and Warner (1985). We apply the CAPM market model and Fama and French (1993) three-factor model. We estimate the parameters based in the window of (-15, -3) month prior to the event and follow Adams and Mansi (2009) to use CRSP equally weighted index as the market portfolio. The results of using value-weighted CRSP index are similar. For each panel, we examine abnormal (excess) returns in 1-month (0, 0), 2-month (-1, 0) and 3-month (-1, +1) windows, where month 0 is the announcement month. (***), (**), and (*) indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: Abnormal Return for Bondholders (%)								
Observation Window	**Full Sample**			**Joint Venture**			**Strategic Alliance**		
(Month)	**N**	**Mean**	**Median**	**N**	**Mean**	**Median**	**N**	**Mean**	**Median**
(0, 0)	3,032	0.39***	0.34***	1,239	0.34***	0.36***	1,793	0.43***	0.32***
(-1, 0)	3,351	0.67***	0.64***	1,323	0.58***	0.64***	2,028	0.72***	0.64***
(-1, +1)	3,351	1.13***	1.23***	1,323	0.97***	1.35***	2,028	1.23***	1.11***
	Panel B: Excess Return for Stockholders (%)								
Observation Window	**Full Sample**			**Joint Venture**			**Strategic Alliance**		
(Month)	**N**	**Mean**	**Median**	**N**	**Mean**	**Median**	**N**	**Mean**	**Median**
(0, 0)	3,351	0.93***	0.13**	1,323	0.42**	-0.05	2,028	1.27***	0.26**
(-1, 0)	3,351	1.30***	0.66***	1,323	0.78***	0.70**	2,028	1.64***	0.65***
(-1, +1)	3,351	1.27***	0.72***	1,323	0.91**	0.35*	2,028	1.50***	0.95***
	Panel C: CAPM Market Model Abnormal Return for Stockholders (%)								
Observation Window	**Full Sample**			**Joint Venture**			**Strategic Alliance**		
(Month)	**N**	**Mean**	**Median**	**N**	**Mean**	**Median**	**N**	**Mean**	**Median**
(0, 0)	3,351	1.09***	0.57***	1,323	0.87***	0.76***	2,028	1.23***	0.47***
(-1, 0)	3,351	1.06***	0.87***	1,323	1.02***	0.98***	2,028	1.09***	0.74***
(-1, +1)	3,351	0.71**	0.86***	1,323	0.78*	1.06**	2,028	0.66*	0.76*
	Panel D: Fama and French 3-Factor Abnormal Return for Stockholders (%)								
Observation Window	**Full Sample**			**Joint Venture**			**Strategic Alliance**		
(Month)	**N**	**Mean**	**Median**	**N**	**Mean**	**Median**	**N**	**Mean**	**Median**
(0, 0)	3,351	0.66***	0.24***	1,323	0.11	0.08	2,028	1.03***	0.33*
(-1, 0)	3,351	1.00***	0.57**	1,323	0.54**	0.68**	2,028	1.29***	0.54**
(-1, +1)	3,351	0.71**	0.49*	1,323	0.43*	0.49*	2,028	0.89**	0.48*

Table 3.3: Univariate test of abnormal bond and stock returns

This table provides a univariate analysis of bond abnormal return and stock abnormal return by categorizing the proxies pertaining to our hypotheses described in Section 2, by different alliance characteristics and by other firm characteristics. Detailed variable definitions are summarized in Appendix A. Panel A and B report the results for joint venture and strategic alliance samples, respectively. We calculate the monthly abnormal bond return for a given bond in a 2-month (-1, 0) period as the raw bond monthly return minus the monthly return of Barclays' bond index which is matched with rating and maturity. The abnormal returns for stockholders is calculated in 2-month (-1, 0) window by using monthly stock return with CAPM market model and with Fama and French (1993) three-factor model. We estimate the parameters based in the window of (-15, -3) month prior to the event. The majority of mean and median values are at least significant at 10% statistical level. We use mean difference t-test for difference in means and the Wilcoxon–Mann–Whitney test for difference in medians. (***), (**), and (*) indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Univariate Test for Joint Venture Sample							
		Abnormal Bond Return (%)		Market Model Abnormal Stock Returns (%)		F&F 3-factor Abnormal Stock Returns (%)	
	N	Mean	Median	Mean	Median	Mean	Median
Full Joint Venture Sample	1,323	0.58	0.64	1.02	0.98	0.54	0.68
Synthesis Effect							
All Synergy (> median)	662	0.50	0.61	1.66	1.99	1.40	1.15
All Synergy (< median)	661	0.67	0.69	0.37	0.23	-0.32	-0.06
Difference		-0.17	-0.08	1.29**	1.76*	1.72**	1.21*
Operating Synergy (> median)	662	0.53	0.62	1.50	1.75	1.23	1.12
Operating Synergy (< median)	661	0.64	0.69	0.53	0.43	-0.15	0.08
Difference		-0.11	-0.07	0.97*	1.32	1.38*	1.04
Financial Synergy (> median)	662	0.87	0.67	1.18	0.93	0.64	0.78
Financial Synergy (< median)	661	0.30	0.63	0.85	1.06	0.44	0.30
Difference		0.57***	0.04	0.33	-0.13	0.20	0.48
Risk-sharing Effect							
Industry Correlation (> median)	662	0.53	0.63	1.13	1.20	0.75	0.69
Industry Correlation (< median)	661	0.64	0.64	0.90	0.94	0.33	0.68
Difference		-0.11	-0.01	0.23	0.26	0.42	0.01
Change of Beta (Post - Pre) (> median)	662	0.62	0.66	0.93	0.90	0.17	0.29
Change of Beta (Post - Pre) (< median)	661	0.55	0.63	1.10	1.14	0.92	1.01
Difference		0.07	0.03	-0.17	-0.24	-0.75	-0.72
Business Focus	727	0.59	0.63	0.78	0.87	0.39	0.70
Non-Business Focus	596	0.58	0.67	1.30	1.44	0.73	0.53
Difference		0.01	-0.04	-0.52	-0.57	-0.34	0.17

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Panel A: Univariate Test for Joint Venture Sample (continued)

		Abnormal Bond Return (%)		Market Model Abnormal Stock Returns (%)		F&F 3-factor Abnormal Stock Returns (%)	
	N	Mean	Median	Mean	Median	Mean	Median
Financial Constraint Effect							
Low Dividends Payout	554	0.76	0.71	2.42	2.31	1.40	1.06
High Dividends Payout	769	0.46	0.59	0.01	0.60	-0.07	0.42
Difference		0.30	0.12	2.41***	1.71***	1.47*	0.64
Financing Deficit (> median)	662	0.55	0.56	1.87	1.18	1.31	0.90
Financing Deficit (< median)	661	0.62	0.74	0.17	0.85	-0.23	0.29
Difference		-0.07	-0.18***	1.70**	0.33	1.54**	0.61
K-Z Index Group (> median)	662	0.82	0.73	2.17	1.79	1.72	1.28
K-Z Index Group (< median)	661	0.35	0.58	-0.14	0.77	-0.64	0.21
Difference		0.47**	0.15**	2.31***	1.02**	2.36***	1.07
Organizational Flexibility Effect							
Volatility of Sales Growth (> median)	664	0.51	0.59	0.71	0.64	0.52	0.70
Volatility of Sales Growth (< median)	659	0.66	0.70	1.32	1.72	0.56	0.64
Difference		-0.15	-0.11	-0.61	-1.08	-0.04	0.06
Volatility of EBITDA/TA (> median)	662	0.59	0.54	1.25	1.69	1.08	1.15
Volatility of EBITDA/TA (< median)	661	0.58	0.71	0.78	0.66	0.00	0.06
Difference		0.01	-0.17**	0.47	1.03	1.08	1.09
Volatility of R&D/TA (> median)	653	0.69	0.65	0.70	0.63	0.03	0.06
Volatility of R&D/TA (< median)	670	0.48	0.63	1.33	1.70	1.04	1.34
Difference		0.21	0.02	-0.63	-1.07	-1.01	-1.28
Deal Characteristics							
Horizontal Alliance	460	0.53	0.61	1.55	1.10	0.91	0.82
Vertical Alliance	863	0.61	0.65	0.73	0.94	0.35	0.42
Difference		-0.08	-0.04	0.82	0.16	0.56	0.40
Foreign Alliance	766	0.52	0.64	1.20	0.96	0.30	0.28
Domestic Alliance	557	0.68	0.65	0.76	1.06	0.88	1.00
Difference		-0.16	-0.01	0.44	-0.10	-0.58	-0.72
Equal Ownership Alliance	930	0.48	0.68	0.45	0.65	-0.13	-0.01
Unequal Ownership Alliance	393	0.84	0.61	2.34	2.61	2.12	1.81
Difference		-0.36	0.07	-1.89**	-1.96**	-2.25**	-1.82***
High-tech Alliance	220	0.78	0.70	-1.18	0.67	-1.95	-0.45
Non High-tech Alliance	1,103	0.55	0.63	1.45	1.42	1.04	0.92
Difference		0.23	0.07	-2.63**	-0.75	-2.99***	-1.37**
Firm Characteristics							
Firm Size (> median)	662	0.42	0.59	0.99	1.72	0.85	1.12
Firm Size (< median)	661	0.75	0.69	1.04	0.60	0.23	0.21
Difference		-0.33*	-0.10**	-0.05	1.12	0.62	0.91
Leverage (> median)	662	0.47	0.64	2.20	1.97	1.83	1.51
Leverage (< median)	661	0.70	0.64	-0.17	0.58	-0.75	-0.05
Difference		-0.23	0.00	2.37***	1.39**	2.58***	1.56**
Market to Book (> median)	662	0.61	0.59	-0.28	0.53	-0.96	-0.11
Market to Book (< median)	661	0.56	0.71	2.32	1.87	2.05	1.31
Difference		0.05	-0.12	-2.60***	-1.34**	-3.01***	-1.42***
Speculative Grade Issuers	421	0.50	0.48	1.50	1.45	0.94	1.01
Investment Grade Issuers	902	0.63	0.69	0.79	0.87	0.35	0.45
Difference		-0.13	-0.21	0.71	0.58	0.59	0.56

Panel B: Univariate Test for Strategic Alliance Sample							
		Abnormal Bond Return (%)		Market Model Abnormal Stock Returns (%)		F&F 3-factor Abnormal Stock Returns (%)	
	N	Mean	Median	Mean	Median	Mean	Median
Full Strategic Alliance Sample	2,028	0.72	0.64	1.09	0.74	1.29	0.54
Synergy Effect							
All Synergy (> median)	1,014	0.84	0.63	3.29	2.04	3.35	1.64
All Synergy (< median)	1,014	0.60	0.65	-1.12	-0.14	-0.76	-0.55
Difference		0.24	-0.02	4.41***	2.18***	4.11***	2.19***
Operating Synergy (> median)	1,014	0.84	0.65	3.28	1.99	3.35	1.61
Operating Synergy (< median)	1,014	0.60	0.63	-1.10	-0.05	-0.76	-0.52
Difference		0.24	0.02	4.38***	2.04***	4.11***	2.13***
Financial Synergy (> median)	1,014	0.77	0.66	0.33	0.23	0.47	0.06
Financial Synergy (< median)	1,014	0.67	0.63	1.85	1.63	2.12	1.18
Difference		0.10	0.03	-1.52**	-1.40**	-1.65**	-1.12**
Financial Constraint Effect							
Low Dividends Payout	742	0.74	0.63	1.65	1.42	2.26	1.63
High Dividends Payout	1,286	0.71	0.64	0.76	0.61	0.74	0.15
Difference		0.03	-0.01	0.89	0.81	1.52**	1.48*
Financing Deficit (> median)	1,014	0.67	0.51	1.29	0.71	2.04	1.17
Financing Deficit (< median)	1,014	0.77	0.69	0.89	0.83	0.55	0.05
Difference		-0.10	-0.18*	0.40	-0.12	1.49**	1.12
K-Z Index Group (> median)	1,014	0.61	0.59	1.27	0.53	2.17	0.98
K-Z Index Group (< median)	1,014	0.83	0.67	0.91	0.88	0.41	-0.06
Difference		-0.22	-0.08	0.36	-0.35	1.76**	1.04*
Organizational Flexibility Effect							
Volatility of Sales Growth (> median)	1,019	0.79	0.58	1.39	0.62	1.50	0.39
Volatility of Sales Growth (< median)	1,009	0.65	0.68	0.78	1.01	1.09	0.82
Difference		0.14	-0.10	0.61	-0.39	0.41	-0.43
Volatility of EBITDA/TA (> median)	1,024	0.62	0.43	0.94	0.54	1.13	0.39
Volatility of EBITDA/TA (< median)	1,004	0.82	0.72	1.24	1.15	1.46	0.71
Difference		-0.20	-0.29**	-0.30	-0.61	-0.33	-0.32
Volatility of R&D/TA (> median)	1,013	0.62	0.63	0.89	0.74	0.30	-0.10
Volatility of R&D/TA (< median)	1,015	0.81	0.65	1.28	0.80	2.28	1.28
Difference		-0.19	-0.02	-0.39	-0.06	-1.98***	-1.38***
Deal Characteristics							
Horizontal Alliance	658	0.88	0.64	2.75	1.85	2.63	1.39
Vertical Alliance	1,370	0.64	0.64	0.29	0.41	0.65	0.21
Difference		0.24	0.00	2.46***	1.44***	1.98**	1.18*
Foreign Alliance	781	0.61	0.63	0.23	0.37	0.35	0.04
Domestic Alliance	1,247	0.79	0.65	1.62	1.17	1.89	0.85
Difference		-0.18	-0.02	-1.39**	-0.80	-1.54**	-0.81*
High-tech Alliance	768	0.87	0.61	1.33	1.01	1.55	1.10
Non High-tech Alliance	1,260	0.63	0.66	0.94	0.52	1.14	0.40
Difference		0.24	-0.05	0.39	0.49	0.41	0.70
Firm Characteristics							
Firm Size (> median)	1,014	0.32	0.53	0.40	0.41	0.43	0.15
Firm Size (< median)	1,014	1.12	0.81	1.77	1.48	2.16	1.11
Difference		-0.80***	-0.28***	-1.37**	-1.07	-1.73**	-0.96
Leverage (> median)	1,014	0.74	0.69	2.70	1.91	3.33	1.97
Leverage (< median)	1,014	0.70	0.56	-0.52	0.11	-0.74	-0.73
Difference		0.04	0.13	3.22***	1.80***	4.07***	2.70***
Market to Book (> median)	1,014	0.77	0.56	0.27	0.09	0.53	-0.45
Market to Book (< median)	1,014	0.67	0.69	1.91	1.81	2.06	1.64
Difference		0.10	-0.13	-1.64***	-1.72***	-1.53**	-2.09***
Speculative Grade Issuers	926	1.12	0.85	2.08	1.84	2.64	1.86
Investment Grade Issuers	1,102	0.38	0.58	0.26	0.40	0.17	-0.04
Difference		0.74***	0.27***	1.82***	1.44**	2.47***	1.90***

Table 3.4: Descriptive statistics of dependent and independent variables used in multivariate regressions

This table describes the characteristics of participating firms, characteristics of bonds issued by these firms, characteristics of alliance activity and market risk factors on event-firm level. Detailed variable definitions are summarized in Appendix A. After we merge SDC alliance data with COMPUSTAT firm financial data, CRSP stock price data, and multiple bond transaction datasets, there are totally 1,323 event-firms for joint venture sample and 2,028 event-firms for strategic alliance sample involving in 3,243 alliances in Table 1 from 1984 through 2011. We apply winsorization at the 5th and 95th percentiles.

	Joint Venture			Strategic Alliance		
	N	Mean	Median	N	Mean	Median
Bond Abnormal Return (%)	1,323	0.58	0.64	2,028	0.72	0.64
Stock Abnormal Return (Market Model) (%)	1,323	1.02	0.98	2,028	1.09	0.74
Stock Abnormal Return (Fama and French 3-factor Model) (%)	1,323	0.54	0.68	2,028	1.29	0.54
Total Incremental Capital Cash Flow (Million $)	1,323	216.28	60.53	2,028	271.19	74.52
Incremental Operating Capital Cash Flow (Million $)	1,323	186.09	40.43	2,028	245.07	63.86
Incremental Financial Capital Cash Flow (Million $)	1,323	21.33	3.73	2,028	20.55	2.30
Synergy Effect (Total incremental CCF)/Total Assets (%)	1,323	1.08	0.83	2,028	2.10	1.73
Operating Synergy Effect (Incremental operating CCF/Total Assets) (%)	1,323	0.86	0.70	2,028	1.91	1.42
Financial Synergy Effect (Incremental financial CCF/Total Assets) (%)	1,323	0.19	0.06	2,028	0.15	0.05
Industry Correlation (%)	1,323	73.86	88.74			
Change of Beta (Post - Pre)	1,323	0.23	0.19			
Business Focus (Dum)	1,323	0.55	1.00			
Low Dividends Payout (Dum)	1,323	0.42	0.00	2,028	0.37	0.00
Financing Deficit (%)	1,323	-0.74	0.16	2,028	-0.68	0.66
K-Z Index	1,323	-3.68	-1.35	2,028	-4.34	-1.97
Volatility of Sales Growth (%)	1,323	8.13	1.73	2,028	13.00	3.56
Volatility of (EBITDA/Total Assets) (%)	1,323	1.01	0.32	2,028	1.76	0.61
Volatility of (R&D/Total Assets) (%)	1,323	0.10	0.00	2,028	0.18	0.05
Number of Participants	1,323	2.45	2.00	2,028	2.18	2.00
Horizontal Alliance (Dum)	1,323	0.35	0.00	2,028	0.32	0.00
Foreign Alliance (Dum)	1,323	0.58	1.00	2,028	0.39	0.00
Equal Ownership	1,323	0.70	1.00			
High-tech Alliance (Dum)	1,323	0.17	0.00	2,028	0.38	0.00

Table 3.5: Cross-sectional regressions of bondholder, stockholder, and firm wealth effects

This table provides the results of cross-sectional OLS regressions for bondholder wealth, stockholder wealth and overall firm wealth around the announcement of alliance event. Detailed variable definitions are summarized in Appendix A. Panels A and B show the results of OLS regression for joint venture and strategic alliance samples respectively. We calculate the monthly abnormal bond return for a given bond in a 2-month (-1, 0) period as the raw bond monthly return minus the monthly return of Barclays' bond index which is matched with rating and maturity. The abnormal returns for stockholders are calculated in 2-month (-1, 0) window by using monthly stock return with CAPM market model and with Fama and French (1993) three-factor model. We estimate the parameters based in the window of (-15, -3) month prior to the event. The entire firm wealth is measured by a leverage-weighted return of abnormal bond return and market model abnormal stock return. All dependent variables are in percentage. We control for industry effects by using the Fama-French 48-industry classification and use year dummy to control year-fixed effect, but do not report the coefficients on these dummies for brevity. The cluster-robust standard errors in firm-level are used in calculating statistical significance. The symbols *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Panel A: Cross-sectional Regression of Stakeholder Wealth on Joint Venture Sample									
		Abnormal Bond Returns		Market Model Abnormal Stock Returns		F&F 3-factor Abnormal Stock Returns		Abnormal Firm Returns	
		Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Synergy Effect									
Synergy Effect	+	0.002		0.081***		0.099***		0.056**	
		(0.136)		(2.839)		(2.828)		(2.387)	
Operating Synergy Effect	+		0.002		0.075***		0.094***		0.052**
			(0.152)		(2.673)		(2.770)		(2.272)
Financial Synergy Effect	+		0.342*		0.128		0.048		0.329
			(1.791)		(0.241)		(0.077)		(0.829)
Risk-sharing Effect									
Industry Correlation	-/+	0.004	0.004	-0.024	-0.024	-0.013	-0.013	-0.018	-0.018
		(0.848)	(0.868)	(-1.373)	(-1.371)	(-0.723)	(-0.722)	(-1.430)	(-1.425)
Change of Beta (Post - Pre)	-/+	0.117	0.099	0.485	0.502	0.017	0.043	0.376	0.377
		(0.396)	(0.334)	(0.658)	(0.679)	(0.019)	(0.050)	(0.670)	(0.669)
Business Focus	-/+	0.398	0.415	-0.397	-0.391	-0.071	-0.071	-0.254	-0.240
		(1.130)	(1.172)	(-0.364)	(-0.358)	(-0.059)	(-0.058)	(-0.301)	(-0.284)
Financial Constraint Effect									
Low Dividends Payout	+	0.217	0.203	1.823**	1.811**	1.122	1.116	1.225*	1.210*
		(0.670)	(0.627)	(2.161)	(2.141)	(1.146)	(1.139)	(1.905)	(1.882)
Financing Deficit	+	0.018	0.018	0.104**	0.102**	0.112*	0.110*	0.081**	0.080**
		(1.062)	(1.048)	(2.070)	(2.028)	(1.730)	(1.703)	(2.062)	(2.023)
K-Z Index	+	0.054	0.053	0.201	0.201	0.278*	0.278*	0.208**	0.208**
		(1.632)	(1.604)	(1.584)	(1.592)	(1.751)	(1.753)	(1.963)	(1.970)
Organizational Flexibility Effect									
Volatility of Sales Growth	+	-0.013	-0.013	0.008	0.008	-0.021	-0.022	0.009	0.009
		(-1.237)	(-1.155)	(0.238)	(0.234)	(-0.668)	(-0.677)	(0.362)	(0.377)
Volatility of (EBITDA/TA)	+	0.149**	0.152**	0.668**	0.658**	0.682**	0.669**	0.541***	0.538***
		(2.146)	(2.193)	(2.297)	(2.260)	(2.117)	(2.064)	(2.623)	(2.603)
Volatility of (R&D/TA)	+	-1.180	-1.225	0.395	0.432	1.929	1.998	-1.988	-1.991
		(-1.004)	(-1.043)	(0.072)	(0.078)	(0.295)	(0.306)	(-0.483)	(-0.485)
Deal Characteristics									
Number of Participants in Alliance	+/-	0.143	0.132	0.223	0.223	0.064	0.067	0.131	0.123
		(1.642)	(1.498)	(0.810)	(0.804)	(0.216)	(0.224)	(0.591)	(0.550)
Horizontal Alliance	+	0.071	0.086	0.541	0.542	-0.102	-0.108	0.648	0.659
		(0.236)	(0.285)	(0.602)	(0.604)	(-0.094)	(-0.099)	(0.966)	(0.983)
Foreign Alliance	+	-0.332	-0.344	0.339	0.341	-0.747	-0.742	-0.147	-0.155
		(-1.143)	(-1.185)	(0.405)	(0.407)	(-0.804)	(-0.796)	(-0.228)	(-0.240)
Equal Ownership	+	-0.618*	-0.590	-2.066**	-2.063**	-2.416**	-2.427**	-1.724**	-1.704**
		(-1.695)	(-1.623)	(-2.081)	(-2.070)	(-2.149)	(-2.155)	(-2.346)	(-2.310)
High-tech Alliance	+	0.137	0.161	-0.686	-0.668	-1.141	-1.122	-0.540	-0.510
		(0.271)	(0.319)	(-0.539)	(-0.524)	(-0.787)	(-0.772)	(-0.551)	(-0.520)
Control Variables									
Log(Total Assets)		-0.141	-0.106	0.234	0.237	0.334	0.329	0.220	0.249
		(-0.831)	(-0.616)	(0.554)	(0.554)	(0.694)	(0.683)	(0.517)	(0.576)
Leverage		-0.019	-0.017	0.061	0.061	0.069	0.068	0.025	0.027
		(-1.185)	(-1.063)	(1.243)	(1.229)	(1.221)	(1.208)	(0.677)	(0.721)
Market to Book		-0.179	-0.198	-2.906**	-2.902**	-3.369**	-3.358**	-2.590***	-2.597***
		(-0.438)	(-0.485)	(-2.501)	(-2.499)	(-2.457)	(-2.444)	(-2.607)	(-2.616)
Log(Bond Size)		0.117	0.095					-0.011	-0.034
		(0.646)	(0.528)					(-0.030)	(-0.093)
Speculative Rating		-0.339	-0.343					-1.668	-1.690*
		(-0.748)	(-0.754)					(-1.640)	(-1.663)
Coupon		0.013	0.017					0.326	0.329
		(0.116)	(0.154)					(1.340)	(1.349)
Time to Maturity		-0.041*	-0.041*					-0.071	-0.071
		(-1.834)	(-1.832)					(-1.465)	(-1.463)
Market Credit Premium		0.720	0.719	1.626	1.604	-1.909	-1.932	0.601	0.584
		(0.590)	(0.588)	(0.626)	(0.617)	(-0.628)	(-0.635)	(0.334)	(0.323)
Level		-0.552*	-0.549*	-0.425	-0.440	-0.036	-0.053	-0.700	-0.704
		(-1.856)	(-1.846)	(-0.539)	(-0.558)	(-0.038)	(-0.055)	(-1.126)	(-1.133)
Slope		0.493	0.482	-2.377	-2.347	-3.258*	-3.224*	-1.645	-1.626
		(0.835)	(0.819)	(-1.405)	(-1.387)	(-1.672)	(-1.652)	(-1.280)	(-1.266)
Equity Market Return		-0.035	-0.039						
		(-0.818)	(-0.909)						
SMB		-0.033	-0.033						
		(-0.596)	(-0.595)						
HML		0.042	0.040						
		(0.748)	(0.700)						
_cons		-1.802	-1.842	-1.180	-1.200	1.753	1.803	0.488	0.533
		(-0.512)	(-0.524)	(-0.155)	(-0.158)	(0.195)	(0.199)	(0.069)	(0.076)
Industry Fixed Effect		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations		1,323	1,323	1,323	1,323	1,323	1,323	1,323	1,323
Adjusted R2		0.015	0.017	0.074	0.073	0.058	0.057	0.076	0.075

Panel B: Cross-sectional Regression of Stakeholder Wealth on Strategic Alliance Sample									
		Abnormal Bond Returns		Market Model Abnormal Stock Returns		F&F 3-factor Abnormal Stock Returns		Abnormal Firm Returns	
		Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Synergy Effect									
Synergy Effect	+	0.024***		0.176***		0.163***		0.137***	
		(2.784)		(7.472)		(6.207)		(7.276)	
Operating Synergy Effect	+		0.024***		0.169***		0.153***		0.131***
			(2.802)		(7.072)		(5.774)		(6.893)
Financial Synergy Effect	+		0.365*		-0.702		-0.945		-0.468
			(1.833)		(-1.174)		(-1.514)		(-0.984)
Financial Constraint Effect									
Low Dividends Payout	+	-0.218	-0.225	0.138	0.176	-0.185	-0.145	-0.106	-0.077
		(-0.620)	(-0.638)	(0.162)	(0.205)	(-0.191)	(-0.150)	(-0.149)	(-0.108)
Financing Deficit	+	0.012	0.013	0.067	0.063	-0.017	-0.022	0.060	0.058
		(0.773)	(0.823)	(1.496)	(1.413)	(-0.347)	(-0.449)	(1.599)	(1.536)
K-Z Index	+	0.018	0.018	-0.134	-0.140	-0.018	-0.025	-0.101	-0.105
		(0.440)	(0.443)	(-1.360)	(-1.417)	(-0.179)	(-0.250)	(-1.141)	(-1.189)
Organizational Flexibility Effect									
Volatility of Sales Growth	+	-0.009	-0.009	0.041	0.043*	0.061**	0.062**	0.022	0.023
		(-1.008)	(-0.977)	(1.629)	(1.678)	(2.059)	(2.096)	(1.161)	(1.211)
Volatility of (EBITDA/TA)	+	0.048	0.049	0.129	0.123	0.310	0.303	0.043	0.039
		(0.679)	(0.695)	(0.766)	(0.728)	(1.542)	(1.500)	(0.319)	(0.287)
Volatility of (R&D/TA)	+	0.184	0.222	-3.278	-3.439	-5.426	-5.615	-2.324	-2.455
		(0.156)	(0.188)	(-1.095)	(-1.146)	(-1.620)	(-1.623)	(-0.922)	(-0.972)
Deal Characteristics									
Number of Participants in Alliance	+/-	-0.143*	-0.147*	-0.012	0.002	0.080	0.097	-0.013	-0.006
		(-1.726)	(-1.776)	(-0.039)	(0.006)	(0.231)	(0.282)	(-0.055)	(-0.026)
Horizontal Alliance	+	0.057	0.048	2.756***	2.785***	2.720***	2.753***	1.786**	1.802**
		(0.181)	(0.154)	(2.911)	(2.945)	(2.627)	(2.662)	(2.398)	(2.421)
Foreign Alliance	+	-0.052	-0.049	-1.304*	-1.328*	-1.201	-1.227	-1.096*	-1.111*
		(-0.183)	(-0.171)	(-1.677)	(-1.709)	(-1.279)	(-1.310)	(-1.709)	(-1.733)
High-tech Alliance	+	0.096	0.076	0.158	0.265	0.003	0.127	0.002	0.080
		(0.314)	(0.251)	(0.165)	(0.280)	(0.003)	(0.124)	(0.002)	(0.103)
Control Variables									
Log(Total Assets)		-0.181	-0.165	-0.558*	-0.556*	-0.559*	-0.558*	-0.511	-0.543
		(-1.095)	(-1.003)	(-1.890)	(-1.880)	(-1.664)	(-1.658)	(-1.353)	(-1.437)
Leverage		0.002	0.004	0.118**	0.113**	0.086	0.080	0.074	0.069
		(0.087)	(0.192)	(2.139)	(2.054)	(1.516)	(1.395)	(1.561)	(1.484)
Market to Book		0.107	0.091	-1.370**	-1.306**	-1.654**	-1.577**	-1.270**	-1.240**
		(0.423)	(0.361)	(-2.072)	(-1.982)	(-2.305)	(-2.212)	(-2.244)	(-2.191)
Log(Bond Size)		-0.234	-0.250					0.178	0.225
		(-1.332)	(-1.422)					(0.464)	(0.589)
Speculative Rating		0.501	0.530					0.129	0.110
		(1.372)	(1.451)					(0.150)	(0.128)
Coupon		0.062	0.062					-0.066	-0.068
		(0.657)	(0.654)					(-0.381)	(-0.395)
Time to Maturity		-0.002	-0.002					-0.064*	-0.063
		(-0.086)	(-0.106)					(-1.650)	(-1.629)
Market Credit Premium		0.052	0.051	2.094	2.109	1.170	1.190	0.870	0.882
		(0.061)	(0.060)	(1.023)	(1.028)	(0.453)	(0.461)	(0.568)	(0.573)
Level		0.235	0.241	-2.132**	-2.174**	-1.720	-1.765	-1.551**	-1.581**
		(0.702)	(0.719)	(-2.228)	(-2.273)	(-1.570)	(-1.613)	(-2.023)	(-2.062)
Slope		0.117	0.135	-0.935	-0.972	-0.784	-0.837	-0.136	-0.164
		(0.228)	(0.263)	(-0.625)	(-0.654)	(-0.483)	(-0.517)	(-0.108)	(-0.131)
Equity Market Return		-0.008	-0.008						
		(-0.214)	(-0.211)						
SMB		0.120**	0.124**						
		(2.207)	(2.277)						
HML		0.007	0.007						
		(0.144)	(0.131)						
_cons		4.178	3.971	-10.627	-9.750	-7.434	-6.389	-13.396	-13.036
		(0.715)	(0.678)	(-0.726)	(-0.666)	(-0.444)	(-0.381)	(-1.061)	(-1.032)
Industry Fixed Effect		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations		2,028	2,028	2,028	2,028	2,028	2,028	2,028	2,028
Adjusted R2		0.004	0.004	0.058	0.058	0.045	0.046	0.051	0.050

Table 3.6: Synergy effects on bondholder wealth by convertibility

This table reports the results of a bond-level analysis about the association between synergy effect and bondholder wealth at the announcements of alliance events. We categorize the sample by bond convertibility. Panel A and Panel B present the regression results of convertible bonds and non-convertible bonds for joint venture sample and strategic alliance sample, respectively. The dependent variables are the monthly individual bond abnormal returns, calculated for a given bond in a 2-month (-1, 0) period as the monthly raw bond return minus the monthly return of Barclays' bond index which is matched with rating and maturity. In each regression we include the measures of synergy effect, deal characteristics, firm characteristics, bond characteristics, and market risk factors as specified in baseline models. The industry effects are controlled by using the Fama-French 48-industry classification and year dummy is used to control for year-fixed effect, but the coefficients of all these controls are not reported for brevity. The cluster-robust standard errors in bond-level are used in calculating statistical significance. The symbols *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Panel A: The Regression of Convertible and Non-convertible Bond Returns in Joint Venture Sample					
		Convertible Bonds		**Non-convertible Bonds**	
		Model 1	**Model 2**	**Model 1**	**Model 2**
Synergy Effect	+	0.070*		-0.005	
		(1.702)		(-1.539)	
Operating Synergy Effect	+		0.067*		-0.002
			(1.785)		(-0.617)
Financial Synergy Effect	+		-0.066		0.215***
			(-0.055)		(3.352)
Control Variables		Yes	Yes	Yes	Yes
Industry Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Number of observations		147	147	5,614	5,614
Adjusted R2		0.169	0.178	0.056	0.057
Panel B: The Regression of Convertible and Non-convertible Bond Returns in Strategic Alliance Sample					
		Convertible Bonds		**Non-convertible Bonds**	
		Model 1	**Model 2**	**Model 1**	**Model 2**
Synergy Effect	+	0.049***		0.003	
		(4.184)		(0.796)	
Operating Synergy Effect	+		0.049***		0.002
			(4.270)		(0.601)
Financial Synergy Effect	+		0.016		0.130*
			(0.045)		(1.748)
Control Variables		Yes	Yes	Yes	Yes
Industry Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Number of observations		652	652	6,484	6,484
Adjusted R2		0.070	0.070	0.045	0.045

Table 3.7: Synergy effects on bondholder wealth by credit rating

This table reports the results of a bond-level analysis about the association between synergy effect and bondholder wealth at the announcements of alliance events. We categorize the sample by credit rating. Panel A and Panel B present the regression results of investment grade bonds and speculative grade bonds for joint venture sample and strategic alliance sample, respectively. The dependent variables are the monthly individual bond abnormal returns, calculated for a given bond in a 2-month (-1, 0) period as the monthly raw bond return minus the monthly return of Barclays' bond index which is matched with rating and maturity. In each regression we include the measures of synergy effect, deal characteristics, firm characteristics, bond characteristics, and market risk factors as specified in baseline models. The industry effects are controlled by using the Fama-French 48-industry classification and year dummy is used to control for year-fixed effect, but the coefficients of all these controls are not reported for brevity. The cluster-robust standard errors in bond-level are used in calculating statistical significance. The symbols *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Panel A: The Regression of Investment and Speculative Grade Bond Returns in Joint Venture Sample					
		Investment Grade		**Speculative Grade**	
		Model 1	**Model 2**	**Model 1**	**Model 2**
Synergy Effect	+	-0.002		0.003	
		(-0.448)		(0.270)	
Operating Synergy Effect	+		-0.002		0.014
			(-0.464)		(1.371)
Financial Synergy Effect	+		0.156**		0.457***
			(2.475)		(2.623)
Control Variables		Yes	Yes	Yes	Yes
Industry Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Number of observations		4,776	4,776	985	985
Adjusted R2		0.045	0.046	0.152	0.157
Panel B: The Regression of Investment and Speculative Grade Bond Returns in Strategic Alliance Sample					
		Investment Grade		**Speculative Grade**	
		Model 1	**Model 2**	**Model 1**	**Model 2**
Synergy Effect	+	0.004		0.023***	
		(1.065)		(2.946)	
Operating Synergy Effect	+		0.004		0.020**
			(1.109)		(2.558)
Financial Synergy Effect	+		0.061		0.173
			(0.834)		(0.888)
Control Variables		Yes	Yes	Yes	Yes
Industry Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Number of observations		5,452	5,452	1,684	1,684
Adjusted R2		0.041	0.041	0.049	0.048

Table 3.8: Synergy effects on bondholder wealth by seniority

This table reports the results of a bond-level analysis about the association between synergy effect and bondholder wealth at the announcements of alliance events. We categorize the sample by seniority provision in bond contracts. Panel A and Panel B present the regression results of senior bonds and non-senior bonds for joint venture sample and strategic alliance sample, respectively. Senior bond group includes bonds denoted with senior class and secured bonds. Non-senior bonds group are the remainder including junior bond, junior subordinated bond, subordinated bond, senior subordinated bond and bonds without any specification in seniority provision. The dependent variables are the monthly individual bond abnormal returns, calculated for a given bond in a 2-month (-1, 0) period as the monthly raw bond return minus the monthly return of Barclays' bond index which is matched with rating and maturity. In each regression we include the measures of synergy effect, deal characteristics, firm characteristics, bond characteristics, and market risk factors as specified in baseline models. The industry effects are controlled by using the Fama-French 48-industry classification and year dummy is used to control for year-fixed effect, but the coefficients of all these controls are not reported for brevity. The cluster-robust standard errors in bond-level are used in calculating statistical significance. The symbols *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Panel A: The Regression of Senior Bond and Non-senior Bond Returns in Joint Venture Sample					
		Senior		**Non-senior**	
		Model 1	**Model 2**	**Model 1**	**Model 2**
Synergy Effect	+	-0.007		-0.002	
		(-1.456)		(-0.297)	
Operating Synergy Effect	+		-0.005		0.001
			(-0.970)		(0.123)
Financial Synergy Effect	+		0.093		0.426***
			(1.036)		(4.151)
Control Variables		Yes	Yes	Yes	Yes
Industry Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Number of observations		3,848	3,848	1,913	1,913
Adjusted R2		0.055	0.055	0.074	0.086
Panel B: The Regression of Senior Bond and Non-senior Bond Returns in Strategic Alliance Sample					
		Senior		**Non-senior**	
		Model 1	**Model 2**	**Model 1**	**Model 2**
Synergy Effect	+	0.010***		0.018**	
		(2.628)		(2.347)	
Operating Synergy Effect	+		0.010**		0.019**
			(2.536)		(2.382)
Financial Synergy Effect	+		0.124		0.216
			(1.431)		(1.323)
Control Variables		Yes	Yes	Yes	Yes
Industry Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Number of observations		5,074	5,074	2,062	2,062
Adjusted R2		0.033	0.030	0.068	0.069

Table 3.9: Synergy effects on bondholder wealth by sinking fund provision

This table reports the results of a bond-level analysis about the association between synergy effect and bondholder wealth at the announcements of alliance events. We categorize the sample by sinking fund provision in bond contracts. Panel A and Panel B present the regression results of sinking fund bonds and non-sinking fund bonds for joint venture and strategic alliance samples, respectively. The dependent variables are the monthly individual bond abnormal returns, calculated for a given bond in a 2-month (-1, 0) period as the monthly raw bond return minus the monthly return of Barclays' bond index which is matched with rating and maturity. In each regression we include the measures of synergy effect, deal characteristics, firm characteristics, bond characteristics, and market risk factors as specified in baseline models. The industry effects are controlled by using the Fama-French 48-industry classification and year dummy is used to control for year-fixed effect, but the coefficients of all these controls are not reported for brevity. The cluster-robust standard errors in bond-level are used in calculating statistical significance. The symbols *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Panel A: The Regression of Sinking Fund and Non-sinking Fund Bond Returns in Joint Venture Sample					
		Sinking Fund		**Non-sinking Fund**	
		Model 1	**Model 2**	**Model 1**	**Model 2**
Synergy Effect	+	0.007		-0.005	
		(0.452)		(-1.214)	
Operating Synergy Effect	+		0.004		-0.002
			(0.233)		(-0.409)
Financial Synergy Effect	+		-0.017		0.206***
			(-0.071)		(2.981)
Control Variables		Yes	Yes	Yes	Yes
Industry Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Number of observations		418	418	5,343	5,343
Adjusted R2		0.229	0.227	0.047	0.048
Panel B: The Regression of Sinking Fund and Non-sinking Fund Bond Returns in Strategic Alliance Sample					
		Sinking Fund		**Non-sinking Fund**	
		Model 1	**Model 2**	**Model 1**	**Model 2**
Synergy Effect	+	0.008		0.013***	
		(0.564)		(3.556)	
Operating Synergy Effect	+		0.010		0.012***
			(0.715)		(3.367)
Financial Synergy Effect	+		0.337		0.127
			(1.371)		(1.534)
Control Variables		Yes	Yes	Yes	Yes
Industry Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Number of observations		780	780	6,356	6,356
Adjusted R2		0.115	0.116	0.032	0.032

Table 3.10: Synergy effects on bondholder wealth by maturity

This table reports the results of a bond-level analysis about the association between synergy effect and bondholder wealth at the announcements of alliance events. We categorize the sample by remaining maturity. Using 3 years as a cut-off of bond maturity, Panel A and Panel B present the regression results of short maturity bonds and long maturity bonds for joint venture sample and strategic alliance sample, respectively. Panel C and Panel D show the cases where we use median value of maturity to separate the sample. The dependent variables are the monthly individual bond abnormal returns, calculated for a given bond in a 2-month (-1, 0) period as the monthly raw bond return minus the monthly return of Barclays' bond index which is matched with rating and maturity. In each regression we include the measures of synergy effect, deal characteristics, firm characteristics, bond characteristics, and market risk factors as specified in baseline models. The industry effects are controlled by using the Fama-French 48-industry classification and year dummy is used to control for year-fixed effect, but the coefficients of all these controls are not reported for brevity. The cluster-robust standard errors in bond-level are used in calculating statistical significance. The symbols *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Panel A: The Regression of Short and Long Maturity Bond Returns in Joint Venture Sample					
		Short Maturity (<= 3 year)		**Long Maturity (> 3 year)**	
		Model 1	**Model 2**	**Model 1**	**Model 2**
Synergy Effect	+	-0.009		-0.002	
		(-0.806)		(-0.454)	
Operating Synergy Effect	+		-0.006		0.001
			(-0.574)		(0.246)
Financial Synergy Effect	+		0.016		0.256***
			(0.091)		(3.606)
Control Variables		Yes	Yes	Yes	Yes
Industry Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Number of observations		951	951	4,810	4,810
Adjusted R2		0.119	0.118	0.044	0.047
Panel B: The Regression of Short and Long Maturity Bond Returns in Strategic Alliance Sample					
		Short Maturity (<= 3 year)		**Long Maturity (> 3 year)**	
		Model 1	**Model 2**	**Model 1**	**Model 2**
Synergy Effect	+	0.009		0.012***	
		(1.015)		(3.220)	
Operating Synergy Effect	+		0.008		0.012***
			(0.904)		(3.125)
Financial Synergy Effect	+		0.147		0.140*
			(0.658)		(1.704)
Control Variables		Yes	Yes	Yes	Yes
Industry Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Number of observations		1,227	1,227	5,909	5,909
Adjusted R2		0.135	0.134	0.028	0.028

Panel C: The Regression of Short and Long Maturity Bond Returns in Joint Venture Sample					
		Short Maturity (< Median)		Long Maturity (> Median)	
		Model 1	Model 2	Model 1	Model 2
Synergy Effect	+	-0.008		0.003	
		(-1.541)		(0.472)	
Operating Synergy Effect	+		-0.008		0.008
			(-1.552)		(1.442)
Financial Synergy Effect	+		0.100		0.322***
			(1.087)		(3.413)
Control Variables		Yes	Yes	Yes	Yes
Industry Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Number of observations		2,879	2,879	2,882	2,882
Adjusted R2		0.078	0.079	0.054	0.058
Panel D: The Regression of Short and Long Maturity Bond Returns in Strategic Alliance Sample					
		Short Maturity (< Median)		Long Maturity (> Median)	
		Model 1	Model 2	Model 1	Model 2
Synergy Effect	+	0.011**		0.013***	
		(2.280)		(2.646)	
Operating Synergy Effect	+		0.011**		0.012***
			(2.164)		(2.597)
Financial Synergy Effect	+		0.105		0.179
			(0.959)		(1.625)
Control Variables		Yes	Yes	Yes	Yes
Industry Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Number of observations		3,570	3,570	3,566	3,566
Adjusted R2		0.067	0.067	0.021	0.021